Pages 1 - 118

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

Before The Honorable William H. Alsup, Judge

WAYMO LLC, Plaintiff, VS. UBER TECHNOLOGIES, INC.; OTTO TRUCKING LLC; and OTTOMOTTO LLC, Defendants.	)	**NO. C 17-00939 WHA**

San Francisco, California
Wednesday, April 12, 2017

TRANSCRIPT OF PROCEEDINGS

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Wednesday - April 12, 2017 **10:01 a.m.**

P R O C E E D I N G S

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THE CLERK: Calling Civil 17-939. It's Waymo versus Uber Technology. The matter is on for a tutorial.

Counsel, can you please state your appearances.

MR. JAFFE: Good morning, Your Honor. Jordan Jaffe for the plaintiff Waymo. With me today is Mr. Perlson, Mr. Nardinelli, Mr. Corredor.

THE COURT: Welcome to all of you.

MR. GONZALEZ: Good morning, Your Honor. Arturo Gonzalez for Morrison & Foerster on behalf of Uber. Also here is my partner Michael Jacobs, my partner Wendy Ray, and the two associates who will be doing the presentation are Esther Kim Chang and Michelle Yang.

THE COURT: Welcome to all of you.

MR. COOPER: Your Honor, John Cooper. I believe that Mr. Gonzalez and Mr. Perlson and I worked out conflict issues yesterday and terms and conditions, and I have an engagement letter for a special master. So I'm here at your disposal.

THE COURT: We're going to come to that. Can you stay for a while?

MR. COOPER: I will be here.

THE COURT: Okay. Good. That's great news to hear.

I have some projects in mind for you, but maybe we won't

get to that today but possibly we will.

MR. COOPER: I will be here till the end. Thank you.

THE COURT: Okay. Thank you for coming.

All right. So we're here for a tutorial, and let's do this -- what did I say? 40 minutes? 45 minutes? 40?

MR. JAFFE: 40.

MR. GONZALEZ: 40 minutes.

MR. JAFFE: 40 minutes.

THE COURT: So you get to go first, and you get to go second. The floor is yours.

MR. JAFFE: Thank you, Your Honor. I'll use this podium since it's next to the --

THE COURT: Just so the public out there will know, the ground rule for this tutorial is everything has got to be in the public domain. So there's no trade secrets going to be shown today. If that's what you came for, too bad. You won't see anything. But this is to educate the judge on things in the public domain. So there we go.

All right. Go ahead.

MR. JAFFE: Thank you, Your Honor.

Once again, my name is Jordan Jaffe, and I'm going to be presenting this today with my colleague Mr. Corredor.

I forgot my clicker. One second, please.

(Pause in proceedings.)

MR. JAFFE: All right. So before I get started, I

wanted to kind of give you a road map of where we're going to go today, the topics that we're going to touch, at least with regard to our portion of the tutorial.

So the first thing that I'm going to talk about are basic principles of LiDAR. What is LiDAR? How does it work? The basic kind of underlying principles in play.

Then we're going to transition into early applications of LiDAR, what it's been used for historically. It's actually -- in its most primitive forms, it's actually not that new. It's been around for about 50 or so years.

Then we're going to fast forward in time, how it's developed over the past few years; and then we're going to transition to how it's been used in self-driving cars, most relevant to this case.

And then continuing on the timeline, we're going to talk about the early self-driving cars, how they use LiDAR, how they use some other sensors that are relevant here.

And then, lastly, we put together some slides on the two patents that we highlighted in our preliminary injunction motion, speaking about the example in the specification, and we can go through those in as much detail as Your Honor wants at the end.

THE COURT: And while you're pausing, I have a question about the way it's spelled, and I want to make sure there's no trick involved here. How do you spell the generic

version of LiDAR?

MR. JAFFE: Sure. So we actually have a slide on this exact point, which is LiDAR or LADAR.

THE COURT: You anticipated me. Go ahead.

Okay. Is that it?

MR. JAFFE: The short answer is, they're two words that essentially describe the same thing. LiDAR would be light detection and ranging. LADAR would be laser detection and ranging. But laser is a form of light, so we're talking about two forms of the same thing.

THE COURT: All right. But I notice that sometimes it's spelled with a small "I" and sometimes with everything else capitalized, and sometimes it's just the "L" is capitalized. And I want to make sure that when I -- if I use "LiDAR" in one way or the other, that one side is not going to come back and say, *Oh, Judge, we thought you were talking about the trademarked thing. We didn't know you really meant generic.* I don't want to be the victim of that.

So I want us to all agree. Here, Mr. Gonzalez, you need to stand up and let's all agree that -- you tell me, does L small i-D-A-R mean any and all versions of LiDAR, or does it mean just the Waymo-trademarked version?

MR. GONZALEZ: The answer is yes, any and all.

THE COURT: Any and all.

All right. So if I were to give you an interrogatory,

which I'm inclined to do, that you've got to go dig up some information within your company on LiDAR, you're not going to come back to me later and say, *Oh, we thought you just meant the Waymo version*?

MR. GONZALEZ: Correct.

THE COURT: Okay. All right.

That's what -- you understand it that way too?

MR. JAFFE: Yes, Your Honor.

THE COURT: All right. So that's good.

So my law clerks, we're going to use L, small I, capital D, capital A, capital R. That way -- now, I'm reserving the right to use any other version too, but if I happen to -- I just don't want to be accused of referring to something much more narrower than I intended.

All right. Go ahead.

MR. JAFFE: All right. So to jump back into this slide, I'm going to start by just talking about the basic underlying principles of LiDAR. And we have a little animation here to help with this, and this is kind of a different kind of detection, sonar.

THE COURT: Echo location.

MR. JAFFE: So we have a little -- we have our little bat here, which is going to send out sonar, so noise. And you're going to see that it's going to bounce off the small little object on the right-hand side, and the time it takes for

those waves to go out and come back is how the bat kind of, quote-quote, knows how far away the object is. And so it's the calculation of the time that it takes to bounce that we're looking at.

So how does this go to LiDAR? So LiDAR is another form of this kind of analysis but instead of sound waves, we're going to use light.

And what we put here on this slide is kind of a definition of what we're talking about in terms of LiDAR or LADAR, with whatever capitalization we may want to use. But the point being is that it's a device consisting of a photon source, that is a light source as it notes here, frequently but not necessarily a laser; and a photon detection system, that is something that detects light coming back; and a timing circuit. And then we also have some optics to help make this all work.

So what are we talking about? How does this work in the LiDAR context specifically?

So what we've got here is we've got another little animation, and we're showing that there's a laser on the left-hand side. It shoots out, it hits the object, and comes back, and we're timing how long that takes.

So let me just do the animation again here. We can see it takes 100 nanoseconds.

And what we do in the little timing circuit on the left-hand side is we're going to ask: Okay. I know the time

of flight, which is this 100 nanoseconds. I know how long the speed of light is. I can use this formula on the top in order to figure out how far away the object is.

So what we've done now is plugged in these numbers -- speed of light on the left-hand side, the time of flight that we just accessed -- divide by two, and we now understand that the object is 15 meters away. And then we've added this little annotation that says, you know, a rule of thumb to put it in a different form is approximately half a foot per nanosecond.

Now, one thing that's going to come up a little bit later that I just want to touch on now is the idea that in our prior slide here you can see that the laser just goes out and shoots right back.

In reality, what we have is we have one laser that comes out and then it doesn't bounce back like in a science fiction movie. What happens instead is it bounces in all sorts of different directions, and what we've labeled it here is kind of this diffuse reflection. And what this means is we need to shoot a lot of lasers out in order to get photons back coming in the second direction.

And some of the literature actually talks about when you shoot out a million photons, only one will come back in the same direction. So we need to use a lot of photons in order to kind of make this work.

Now, taking this a step further, I've depicted here an

example of a LiDAR, and I'm going to just walk through each of the pieces.

Basically what we're doing here is we're going another step under the covers and saying, *Okay. We understand the principles involved. How does it work?*

So the first thing we're going to talk about is what's called this control and acquisition part, and what we've done here is shown a circuit. This is similar to the timing circuit that we talked about before. This is telling the signal when to go, measuring the time of flight, things like that.

So the first thing it's going to do is tell the signal generator, *All right. Time to generate a signal.* And specifically what it's going to do is do a pulse of light. It's going to generate kind of a wave of light in a laser or other light source. The example here I'm going to use is a laser.

It's then going to go out through the transmit lens, which we'll talk about in a little bit more detail shortly, but it's going to go out through the transmit lens, which is going to do a couple things. But then it's going to go to a target, assuming there is a target or other object, and it's going to come back, and then it's going to hit this receiver or detector that we've talked about here. And what this is is a photodetector.

So what this means is it's a piece of semiconductor

material that takes photons in and converts those in an equivalent amount or some relationship to an amount of current. So then it can send a signal back to the control and acquisition part and say, *Okay. I've got some hits.* And then it can do that time-of-flight calculation we talked about before in order to figure out how far away the target is.

So I touched a little bit earlier on the two lenses here. Just to give a little bit more detail on what they are doing in the example that I talked about before, the top one is going to do two things. It's going to collimate the light, which is project, and the two things it's going to do are project the outgoing beams and make them parallel to one another. So you can see it changes which direction they're going and makes them parallel.

On the other side, the receive lens, what it's going to do is it's going to focus the incoming beams on the detector that we talked about earlier. So it's got to aim them in exactly the right spot where the detector is or that small number of photons, we're going to miss them and then we're not going to get any range information.

Taking a step forward, what we have here is an example of a laser, and what this diagram shows is essentially a laser diode. Now, a laser diode is an example of a laser that's useful for one reason because it's small, and it's also relatively inexpensive; but some systems get more expensive

when they use laser diodes because there's what's called a high divergence -- and that's what we've marked in red here on the right-hand side -- which means that the light kind of sprays out in a cone formation and it's an unequal cone. It's kind of an elliptical as it's noted here. So that creates all other sorts of problems that have to be compensated for in the system.

So the example LiDAR I was talking about before is what's called a bistatic LiDAR.

Now, I'm going to show a second example here, and this one is called monostatic. What that means is there's one lens instead of two, and there's what's called a transmit and receive combiner. And "TX" and "RX" in this context means transmit and receive.

Now, this design typically talks about a single-beam design, and the reason for that is because we have this combiner that includes some kind of specifics in order to make this work in order to be able to transmit and receive using the same area.

And just to give a little bit more detail in an example of how this works, again, in the single-beam context, what we have here is a different diagram showing how a single-beam monostatic LiDAR works. Again, we're talking about single lens, single beam.

So here what we're showing is on the left-hand side we

have our laser. It goes through what's called a polarizing beam splitter and then it goes through a couple other things. But, in essence, it goes out into the world through the lens.

On the reverse side in terms of reception, it comes back and hits this polarizing beam splitter, and it reflects down to the bottom.

Now, just to give a little bit more detail on what is a polarizing beam splitter, how does this work. So, in essence, what it is, is it's a filter that lets light go through one direction -- that's the laser on the left -- but when light comes back the other direction, it's going to block it and hit it to a mirror and that goes on the bottom.

Now, it gets difficult here because there's certain optical problems, which we've eliminated from this picture, but there's certain optical problems and degrees of tolerance that become harder in this design versus the bistatic design that we were talking about earlier.

So next we're going to talk about early applications of LiDAR. I'm going to hand it off to my colleague Mr. Corredor.

THE COURT: All right. Thank you.

MR. CORREDOR: Thank you, Mr. Jaffe.

Hi. I'm Felipe Corredor. I'll be continuing our presentation today.

So now that we've covered what the basic principles of LiDAR are, I'd like to discuss what has LiDAR actually been

used for.

Some of the earliest applications, as you can probably figure out, is just finding the distance to a target. This is called range finding, and this was a very widespread application soon after the invention of the laser in the 1960s and 1970s, especially by militaries around the world.

Here I'm depicting an example to illustrate that the same time-of-flight principle that we've been discussing with Mr. Jaffe can apply to longer distances. So, for example, in a military application it might take 10 microseconds for the beam to reach the target; and then using the formula that we saw earlier, you can compute that that translates to 1.5 kilometers distance.

Now, in the literature, this is sometimes known as single-point or zero-dimensional LiDAR because all you're getting -- the only information you're getting is the distance to a specific point in the environment, your target. So that's why it's known as 0-D LiDAR.

What you can do with such a single-beam LiDAR is you can actually sweep it across a plane, as will be shown in this slide. And by sweeping the single-beam LiDAR across a plane, you can get information about the points lying on that two-dimensional plane. For example, NASA and the U.S. Geological Survey did this in the early 2000s to map out the topography of areas of interest as depicted here.

And what it looks like is there's a neat animation here. It's still the single beam and you're finding the distance to each point; and as the plane moves forward, this two-dimensional plane where the LiDAR is scanning moves forward and gets you a little bit of a sense of a three-dimensional map of the underlying environment.

Now, how does this actually work? This next slide explains how people used to do this in those early days. Basically you have some kind of mechanical moving part. Usually a rotating mirror. And your laser and detector electronics, the components Mr. Jaffe talked about earlier, stay largely stationary. And then as the rotating mirror moves, you're able to scan across the plane depicted here by the blue semicircle, and you get information about all the points lying on that plane.

Now, what does that information look like? That information is called a point cloud. So what you're getting is range information, how far each point that the laser hits is from your LiDAR unit. And as you scan it across a plane, you can figure out how far each point is.

So, for example, if you have a room here with a blue curved wall and a little green box in the middle, as you sweep the single-beam LiDAR system across the plane of the room, you get the following: Which is a bunch of blue points representing the blue wall; and then where the wall is

obstructed by the green object, you see closer points.

This is a very important concept for LiDARs, the point cloud, because this is basically what enables a LiDAR to see the environment by making lots of different range calculations to many different points in the environment.

So that's how we get to self-driving cars. I mean, LiDAR systems using the point cloud concept are able to see the environment around there, and that enables self-driving cars to not only see the world but also feed this information, the 3-D point cloud, into the computer and run the software and make decisions -- get the computer to make decisions for how to drive the car, when to slow it down, when to stop, et cetera.

So here's a depiction of an early 3-D point cloud from the early 2000s from the report we submitted to Your Honor I believe last week. So as you can see, it's a very detailed point cloud. You can make out two very clear cars on a flat road, perhaps a parking lot under a tree.

Now, the main problem with the LiDARs, if you're scanning a three-dimensional environment with a single-beam scanning LiDAR, is you need to scan in two directions. So not only are you moving across a plane, but you also have to scan the plane up and down, and this takes a long time.

In this paper they noted that to generate this high quality of a point cloud, you needed to spend several minutes sweeping the LiDAR across the environment.

But when you do get the 3-D point cloud, this 3-D point cloud has a lot of information. So as you may have figured out, each point has at least four parameters. Three of them are the obvious X, Y, Z parameters, which tell you where exactly in the world is this point in relation to your LiDAR unit.

And then many LiDAR systems -- we have not discussed this yet, but many LiDAR systems also allow you to make a measure of reflectivity. As Mr. Jaffe mentioned, when you shoot out lasers, very few photons actually come back, but different surfaces and different colors can have different reflectivity.

So, for example, if you're looking at the road surface, there might be white lane markings on a dark pavement, and the white lane markings send more photons back -- reflect more photons back, and so that you will be able to see this using the LiDAR system because you can -- the detector can measure that there was more photons that actually came back as opposed to the dark pavement next to it, which had very few photons coming back.

And another neat thing you can do with point clouds is you can actually rotate them and manipulate them. So these four parameters are very easy for a computer to manipulate and it's very powerful. You know, it's basically an image of the entire world around the car.

Now, how would you do this with the single-beam scanning

LiDARs that we've been discussing? Basically the single-beam LiDARs scan across a plane, which is not good enough for self-driving cars because you need to be able to see short objects, you need to be able to see signs hanging overhead. So what people figured out early on is you'll just take one of these 2-D scanning systems and you'll just nod the unit up and down so that you scan the 3-D environment around you.

Now, this has a big problem in that it takes a long time. It misses a lot of points so you get very low resolution in the point cloud. And because it takes a long time, the refresh rate is very low. And what the refresh rate is, is how often does the scenery update. Like this 3-D point cloud is what the world looked like several minutes ago versus a few seconds ago. And in a self-driving car you really want to be able to update the scene several times every second.

Now, with those early types of LiDARs, if you mounted them on a moving car and you tried to sweep the three-dimensional environment around the car, this is what you would get: A very low resolution, low quality point cloud that you can't really make out the objects in. For example, maybe you can tell the road is flat in front of the car and that there's, like, some kind of objects on the sides of the road, but that's about it. It's a far cry from the nice picture we were looking at just a few moments ago.

So this slide just summarizes the points I've already

discussed, which is scanning generates very low quality point clouds because you're scanning a three-dimensional environment using an inherently one-dimensional single-beam LiDAR, and you need to sweep that in at least two directions and then it takes too much time leading to low resolution and a low refresh rate.

And, in addition, there's a very fundamental limitation you have to understand when you have a single beam is that you have to wait for the laser to hit the target, come back, and then you can sweep. So it's a very mechanical process and it takes a long time. You're just inherently limited by the fact that you only have one laser and one detector and you cannot take more than one measurement in parallel.

So when the Department of Defense looked at this in the early 2000s, they wanted to make self-driving cars for military applications in combat zones, and they realized that the ongoing research and development programs were -- actually they were not good enough. They didn't see anything promising and so what they did is they instituted what's called the Grand Challenges, which were a contest for anyone who wanted to enter -- usually academic institutions or big companies -- and the point of these was to try and build a self-driving car in a simplified environment.

They used -- in the first two Grand Challenges they used a desert course. And in that course, you have two main requirements for sensing of the environment. One is sensing,

which is mapping out what it looks like: Is there other cars -- are there other cars near you? Is there any obstacle in the way? And you also want to be able to map out the terrain underneath the car so that you can localize the car on a map and figure out where it is and where you want to go if the car is going to drive itself.

So in 2004, the first course took place in the Nevada desert, and no team was able to complete the course despite the relatively simple nature of the challenge being in a desert and not too many obstacles around.

Now, so DARPA doubled the reward, and in 2005 the challenge had a $2 million prize, and five teams completed the course. The Stanford team won, and the Stanford team was led by Sebastian Thrun who later went on to found and lead the self-driving car at Google.

Then in 2007, the challenge got a little bit more complicated. They wanted to see if you could figure out a way to run self-driving cars in a simplified urban environment, so they used a closed Air Force base. And in this contest, several teams completed it and CMU, Carnegie Mellon University, won the race, and that team was led by Chris Urmson, who also later after Sebastian Thrun led the self-driving car project at Google.

Now, what did the DARPA contestants learn from these Grand Challenges? What they figured out is that you needed to use

different sensors in combination to be able to get you a view of the world. And so many of the teams would use LiDARs, radars, and cameras together.

Now, LiDARs we've been discussing, so we should be familiar with by now; but radars have an inherent disadvantage in that because they use radio waves, the wavelengths are very long and the resolution is just limited, you can't get as sharp a resolution as you can with LiDAR.

And cameras, the inherent problem with cameras is that you rely on outside light to take pictures. So if it's night out, if it's dark, if you're under shadows, if the sun is too bright and it's blinding your camera, you can't really see.

Now, this is still a developing area so no one knows what combination of sensors, you know, commercial self-driving cars will have, but not everyone thinks commercial self-driving cars will have LiDAR. For example, Tesla opts not to use LiDARs in their systems.

There's a regulatory framework in the contest. So DARPA really started a lot of research and development in this area. Eventually the NHTSA instituted a regulatory framework that really maps out the self-driving car classification from level one, which is assisted, very simple self-driving tasks, basically just like follow the car in front of you, adaptive cruise control. And for that you can use very simple like 1-D LiDARs. You don't even need to sweep them perhaps.

And then levels four and five are the most complex. When you talk about self-driving cars, you really are talking about levels four and five, which is no human driver is needed, basically.

What did the DARPA teams use in terms of LiDAR? Some of the early commercial systems that the DARPA teams used were RIEGL and SICK LiDARs. These are two of the scanning LiDARs of the types we've been discussing.

But there were also options with a multibeam scanning LiDAR, so this is an extension of the principle of the single-beam scanning LiDARs but now you have multiple beams, one on top of the other, so as to get a better view of the world. For example, in this patent from 1993, you could be able to make out the stop sign by shooting four light beams -- laser beams at it.

The main disadvantage, as Mr. Jaffe briefly mentioned, is that doing so really complicates the optics, but it was known that -- I mean, people had done it in self-driving ranging cars.

At the time of the DARPA challenges in the late 2000s, there were commercial systems, such as Ibeo's LUX system, that could use four scanning beams to sweep the environment so as to get a little better 3-D sense of what's around the car.

One of the teams in the 2005 -- one of the teams in the 2005 challenge actually developed their own LiDAR system, which

was a 64-beam LiDAR system that had a 360-degree field of view horizontally and a 20-degree vertical field of view. This was team DAD, which was composed of two brothers, David Hall and Bruce Hall. They ended up commercializing this system under the company Velodyne, and this is depicted here. Their system was called the HDL-64.

This is a good example of how complicated the optics can get when you have a lot of beams. I'll show you an image that's still oversimplified.

Basically the Velodyne system has two optical cavities, one on top of each other, and each optical cavity has three sets of lenses; two transmit lenses on the outside and two receive lenses, which are slightly larger in the middle.

Now, you shoot outgoing beams from the transmit lenses and then you receive the incoming reflection in the receive lens, and you do that a lot of times. Here we've only depicted it four times but in reality there's 64, there's 16 behind each transmit lens, and this goes on very fast as the whole unit rotates.

In 2007, however, at the Urban Challenge, people realized that, you know, the Velodyne sensors were pretty good but they were not good enough for urban driving. And the main problems that people found out was that it had insufficient angular resolution at long ranges and it was a very unwieldy unit.

And how unwieldy is illustrated in the next slide where we

show an 8 by 8 by 11 unit that weighs 28 pounds. And this is meant to be mounted on top of the car, so it's going to be a really big ugly contraption on top of the car. Not only that, because it's so unwieldy -- partly because it's unwieldy, its price is over $70,000, which is more than the cost of most cars out in the world.

And this last slide is meant to illustrate a little bit of why the system is so expensive and why the optics are so complicated. And the main point is that the lenses -- manufacturing lenses is challenging and you can never really get two lenses the way you've designed them. There's always some kind of manufacturing tolerance that introduces error into the system.

And so what you need is to align each laser diode perfectly with the receiver on the other end. But because of the laser -- of the lens imperfections, you don't know exactly how the alignment is going to work out until you actually build the system and test it out.

So Velodyne thought of doing a laser diode, placing one laser diode on each board as shown in the middle figure here, and that would allow you to manually align each laser so that, you know, if you see that when you're getting a receive signal back, you're actually missing the detector slightly, you can slightly move the laser beam -- laser diode so that the beam adjusts orientation.

And this is a very painstaking and expensive process because, remember, there's 64 of these and you have to repeat the process 64 times leading to a very expensive overall system.

Now, I'd like to turn it back to Mr. Jaffe to conclude our presentation.

THE COURT: Sure.

MR. CORREDOR: Thank you.

MR. JAFFE: All right. So I'm going to speak a little bit about the two patents that we've asserted in the preliminary injunction motion. I'm just going to go through the example in the specification to talk about that design and how it works in the context of the technology that we've talked about today.

Just as a little bit of background, it was filed in 2013 and issued in 2014. And this is the '922 patent that I'm speaking about right now, and then it lists the named inventors here.

And then on the next slide, we have the '464 patent, and the main thing to be aware of when we're talking about the '464 patent is that it's a continuation of the '922. So the specifications between the two of them are going to be identical. So I'm going to refer to the '922 patent here, but just with the caveat that the specification in the '464 is the same.

The first thing we're going to look at here are a couple of the figures. And on the right-hand side is kind of what we're talking about here, which is a LiDAR. And what this is is a multibeam LiDAR, and one of the uses for this is shown on the left-hand side, which it can be mounted on the top of a car. It can be a LiDAR for use in self-driving car applications.

So on the left-hand side we have a picture of kind of what it looks like on the outside. All you can see is the housing and the lens. That's element 350 there labeled. It's kind of small to see, but we'll go into it in more detail in a second.

So taking a step further into this, what we're going to do is on the next slide here what I've shown is Figure 2. So what Figure 2 is is basically what we have in Figure 3; but imagine if we looked in the top of it, took off the top, and are kind of looking at an x-ray version of what's shown in Figure 3.

And so what I'm going to do now is walk through the different parts of Figure 2 and talk about how this particular example of a LiDAR in the '922 and '464 patents works. And what I'm going to do is I'm just going to walk through the different parts of the specification in order to do that. So just talking about the basic building blocks here.

What we have -- and I've highlighted each part -- is there are a number of different elements. So the first element that we've kind of put in a yellowish-orange, I guess, is the device

itself. We're talking about a LiDAR device. And I think here we can see it's all in caps and that's still -- we're still talking about LiDAR, though.

The next thing to see is what's labeled as the housing -- that's in blue -- and that's just the circle that kind of houses the device.

And then kind of getting to the inside of it, the next element that we have is marked in red, and that's called the transmit block. And as we'll see in a minute, what we're talking about here is the part of the LiDAR that transmits the lasers; that is, where we're going to shoot lasers from.

What we have in green is called the receive block. So what we're talking about here are the photodetectors that I spoke about earlier, the part that's going to be able to detect the photons that come back in order to conduct that time-of-flight calculation I talked about before.

Next what we have, we have the lens, which is in purple.

And then the area that's labeled in gray -- or marked in gray I should say -- is what's called a shared space. And in this example why it's called a shared space is because there are photons that are being received and some photons that are being sent both sharing in some sense some of the same area.

So let's talk about the transmit block in particular. So what this is going to have is a plurality of light sources. What does that mean? In this example, we're talking about a

plurality of lasers; for example, laser diodes. And here we have these elements that are labeled in yellow 222A through 222C, and they're going to be arranged along a curved focal surface.

Now, what does that mean? What that means is that the way that the laser diodes are arranged on this transmit board, which is a printed circuit board, in some sense mirrors -- or not mirrors but matches the way that the lens is curved and the focal curvature of the lens.

So we have -- again, we have a plurality of light sources and they're arranged along a curved focal surface. And here we're showing three transmit boards that are aimed in kind of a similar direction. And so what we're going to see now is the lasers are going to shoot out, and I've marked that in red. Those are the plurality of light beams. And they're going to hit a mirror here (indicating), which is labeled 224 in purple.

And what they're going to do after they hit that mirror is they're going to go through what's labeled 226, which is called an aperture. And for purposes of this example, it's a hole. And what it is, it's a hole that goes through what's labeled in 244, which we'll talk about in a bit, but it goes through that small aperture and then it goes out into the lens; and the lens does the collimation which we were talking about earlier, which is projecting the lens and making them parallel to one another.

Now --

THE COURT: So just to pause on that for a moment.

MR. JAFFE: Sure.

THE COURT: You say "parallel to each other." So if they're parallel to each other, they're not going to focus on anything. They'll always be parallel. Do you really mean parallel, or do you mean that they're going to focus on something, say, a hundred feet out?

MR. JAFFE: Sure. So let me clarify.

THE COURT: What's the answer to that?

MR. JAFFE: Yeah, so let me clarify that.

So one of the important things that this LiDAR is doing is what's called a multibeam LiDAR, so what we want to do is send out multiple beams to look at things.

So if you look at the kind of arrows that are above what's labeled as 250, the lens, they're each going to be directed at different points out in the environment; and then they're each going to come back in different areas, and they're going to go to separate photodetectors which are on the receive side.

So instead of having -- so if you can imagine it like we have -- I talked about single-beam LiDARs before. Imagine if I had six -- the most simple example, imagine if I had six of them on a table and I were going to shoot them all out together and get responses. I would get more information about the environment by doing that.

THE COURT: All right. So in your diagram, though,

you have three.

MR. JAFFE: Right.

THE COURT: Right. And you're telling me that each of those three arrows is aimed at a different far field, near field, medium field, whatever you want, but it's aimed at three different spots?

MR. JAFFE: Right.

THE COURT: All right. Well, okay. They can't then be parallel. They would be slightly off, wouldn't they, just ever so slightly off?

MR. JAFFE: I think that may be right. To some extent, it depends on the curvature of the lens.

THE COURT: I question that, but all right. It's your tutorial. You go ahead.

MR. JAFFE: Okay.

THE COURT: But your main point is that each of the three beams will hit some three different spots somewhere out there, and they're going to bounce back? Some of the light is going to bounce back?

MR. JAFFE: That's right.

THE COURT: All right. Okay. I got that part.

MR. JAFFE: So to talk about the flip side of this equation here, we're going to -- as I mentioned earlier, we're going to send all this light out. Some amount of light is going to come back. It's going to come into the receive

lens -- I mean, into the lens here that we've labeled 250 here in purple; and you can see that it's going to come back, and it's going to hit this reflective surface 242. And for our purposes, we can just treat it as a mirror here.

And the photons, they're going to come back through the lens, they're going to be bounced off this mirror, and they're going to go to the receive block 230, which we've labeled in yellow.

What is the receive block? So it's a plurality of photodetectors. And so to just expand on the point that Your Honor was raising, it's important to understand that we were talking about the transmit boards and the laser diodes on there. And let's say -- just to use an overly simple example, let's say we had six on the transmit side. In this kind of example, a similar design, we have six individual photodetectors on the receive side and they would map one to another. They'd be pairs.

And the lens --

THE COURT: Wait. What do you mean pairs? You mean the transmit and receiver pairs?

MR. JAFFE: Exactly.

THE COURT: Okay.

MR. JAFFE: Yes.

THE COURT: But if you had -- you keep saying -- you say six, but on the diagram here we've got three; right?

MR. JAFFE: Sorry. I was just making a simple example.

THE COURT: Let's stick with three for a minute. Each of those three on the receive side are focusing on a unique point out in the real world somewhere; correct?

MR. JAFFE: Correct.

THE COURT: But three different points?

MR. JAFFE: Yeah. I mean, to clarify one part, I was making this example a little bit simpler by talking about six.

Just to go a little bit ahead just to show you something, what we're looking at here is another figure from the patent. On the left-hand side, this is an example of a transmit board that we've been talking about; and on the left-hand side what you can see is an array of these laser diodes that we've been speaking about.

And so when we're talking about this diagram here in Figure 2 and in particular the elements 220 -- so let me see one where there's highlighted -- the ones in yellow, those yellow points, if we were to pull them out and look at them, are these (indicating) on the left-hand side.

THE COURT: Right, except you've got more than three, but -- now, in your -- on this one, this Slide Number, looks like, 61 -- is that right?

MR. JAFFE: That's correct.

THE COURT: -- this slide, does each one of those

light-emitting diodes focus on a unique point or -- I think the answer is yes, but let me make sure I understand it.

So on that one, you've got what, 10 or 11 diodes and each one of those would focus on some unique point separate from the others?

MR. JAFFE: That's right.

THE COURT: Okay. Now, on this example, though, you've got one diode and it's -- you have it emitting two different beams. Do you see that? You've got two red lines going to the lens.

MR. JAFFE: Yeah. So that's just showing the kind of how it expands.

THE COURT: What do you mean?

MR. JAFFE: So I spoke earlier about the -- how the light kind of expands out. This is just a diagram kind of showing how it expands out.

THE COURT: It wouldn't really expand that much, would it, or does it?

MR. JAFFE: No. You're right.

THE COURT: It would be a very slight -- all right. But, in any event, the purpose of the lens is to refocus it --

MR. JAFFE: That's right.

THE COURT: -- on a unique point in the field.

All right.

MR. JAFFE: That's right.

THE COURT: Okay.

MR. JAFFE: So just to rewind a little bit where we were --

THE COURT: By the way, I think the way you have that, this color-coded thing, is extremely great. That's one of the best animations I've ever seen, so good for you.

MR. JAFFE: All credit to Mr. Corredor on that one.

THE COURT: All right. Well, he gets an A plus.

MR. JAFFE: So I think where I left off was we were at the receive block in talking about the plurality of detectors; and so just to rewind a little bit, we sent out some light. It went out through this aperture. It goes through the lens, comes out. We get some amount of photons that come back. And then they bounce off the mirror and go to the individual photodetectors that correspond to individual laser diodes.

Now, I have a little bit more, but I realize I'm running short.

THE COURT: You're almost out of time.

MR. JAFFE: So I wanted to just --

THE COURT: So how do they align these things in there? If that's a trade secret, I don't want to get into it, but if it's in the public domain. Do you sit there with a little tiny screwdriver and having somebody 75 yards away and you know exactly what point you want to hit and you just keep adjusting it till it hits that spot? How do they align these

things so precisely?

MR. JAFFE: So what I'll say is the way that this example talks about when we're talking about the patent is the curvature of the transmit board in a sense matches the curvature on the receive side, and in that way it can help with the alignment that you're talking about.

THE COURT: All right. I have one other question. It has nothing really -- in 50 years or 10 years or 5 years, whenever the entire roadways are filled with these cars, how are they going to know -- aren't the light beams from some other car going to confuse your car, or is there a way to distinguish between your light beam versus somebody else's light beam?

MR. JAFFE: So that's actually a good question, and the -- what we found and what I've -- you know, I'm not a LiDAR engineer by training, but what we found on this case is that's one of the things that Waymo has been investigating; and when they log all these miles, they've actually found some edge cases that relate to this problem and come up with some solutions to that.

THE COURT: All right. But it is a question. They're working on it. I don't think that's part of our case, but I am curious about that.

Okay. Why don't you -- you've run out of time, but I'm going to give you kind of like a rebuttal, three or four

minutes, later if you want to comment on their presentation. But why don't you have a seat, and my thanks to you both. Let's hear from the other side.

MR. JAFFE: Thank you, Your Honor.

MS. CHANG: Your Honor, may I place this device on the lectern?

THE COURT: Yes, please put it right there.

MS. YANG: Your Honor, before I begin, we gave copies to the reporter, but can I bring copies to your clerks?

THE COURT: Sure. Go ahead.

(Pause in proceedings.)

THE COURT: And your name again?

MS. YANG: Good morning, Your Honor. My name is Michelle Yang. I thank you. I'm from Morrison & Foerster. I'm here on behalf of defendants. And with me is my colleague Esther Kim Chang, and she will present a portion of this presentation.

THE COURT: Great. Go right ahead.

MS. YANG: I will begin the presentation with a discussion of the history of LiDAR in the context of self-driving cars. And then Ms. Kim Chang will talk about optical concepts, she will discuss the Velodyne HDL-64E sensor that's placed right here on the lectern, and she'll walk through some design and manufacturing considerations in the public domain.

Your Honor asked about prior art bearing on this case, and so we will discuss some sources, such as papers, dissertations, textbooks. And you have that before you in a binder, but it's fairly massive so we will actually have the quotes on the slide.

In the end, I will come back and talk about one of the design considerations, that of beam spacing, and what that has to do with LiDAR technology and the information about beam spacing in the public domain.

To recap slightly, LiDAR stands for light detection and ranging, and you saw that people also use the terms LADAR or laser radar in older references.

Perhaps the best way to discuss how LiDAR works is to discuss an early application of LiDAR. One of the earliest applications of LiDAR was the use of retroreflectors placed on the moon by the whole missions to measure the distance between the earth and the moon.

What happened was scientists directed a laser beam at those retroreflectors. The beam bounced off those reflectors, came back to earth, and was detected as a signal. From there, the scientists calculate the time elapsed between sending out the beam and receiving a signal, and then they use the equation the time elapsed by the speed of light divided by two for the round trip from the earth to the moon, and that's how we know the moon is a certain distance away from the earth.

THE COURT: What is that distance?

MS. YANG: I don't know unfortunately. I'll find out.

THE COURT: 186,000 miles I think, but what is the exact number?

MS. YANG: I'll have to find out, but I do know that they got it within 3 centimeters of the distance.

THE COURT: Really?

MS. YANG: Yes. This is from an episode of *MythBusters*. I think season four.

(Laughter)

THE COURT: All right. That's good. Go ahead.

MS. YANG: In 1985, the Defense Advanced Research Projects Agency, DARPA, funded the Autonomous Land Vehicle Project. And you saw previously a photo of the NavLab.

So Carnegie Mellon University's Robotics Institute funded with DARPA money the Navigation Laboratory Project. And the first NavLab, the NavLab 1, was a van that was computer controlled -- so no human behind the wheel -- using a laser range finder from the Environmental Research Institute in Michigan, the EIRM laser. That range finder here is marked in a giant red box, so that's the size of the range finder.

The EIRM laser used two mirrors to direct the beam in an 80-degree horizontal field of view and a 30-degree vertical field of view.

And as shown on the next slide, what was needed was to

measure the time of flight, calculate the time elapsed between sending the beam and receiving a signal, and from there they could calculate the distance of objects in front of the NavLab vehicle.

Through the rack of computers shown here in this diagram -- back then the rack of computers was 639 centimeters wide -- an entire stack of them, they could calculate the data and produce a 64 by 256 pixel image. That was advanced technology for 1985.

By the 2000s, DARPA used congressional money from public funding to provide million-dollar prizes for the DARPA Grand Challenge.

And you heard about the 2004 and 2005 races. Well, in 2007, it was the DARPA Urban Grand Challenge. It was a closed course, 60 miles on an Air Force base. Unlike the previous DARPA Grand Challenges, the self-driving cars there had to navigate traffic laws -- traffic rules and avoid bumping into each other.

The winner of the 2007 DARPA Grand Challenge was Carnegie Mellon University in a General Motors car, the "Boss," and on top of that "Boss" car was a Velodyne sensor, a 360-degree spinning LiDAR with 64 laser beams.

I do want to note that one of the entrants in the 2004-2005 DARPA challenge was the "Ghostrider." It took me a moment to realize this, but it's called the "Ghostrider"

because there's no rider on the actual car -- on the actual motorcycle.

This "Ghostrider" did not use LiDAR. It used two forward-facing stereo cameras. In the back folded up are two arms that could right the motorcycle when it toppled over.

And the "Ghostrider" was the only two-wheeled entrant to enter -- to make it to the semifinals of the 2005 Grand Challenge. Today it is in the Smithsonian, and it was created by a team from the University of California at Berkeley led by Anthony Levandowski.

In the modern self-driving car, a variety of sensing options are used. Marked in red here, it's a 360-degree spinning LiDAR, but there are also front-facing cameras, rear and side cameras, radar coverage, as well as an inertial measurement unit because the car is being jolted. So the IMU measures the pitch and adjusts the data to account for the shaking and jolting. And, of course, you need significant computer and data storage capabilities to handle processing all this data.

And with that, I pass the presentation on to my colleague.

THE COURT: Okay. I may be wrong about the 186. I think that's the speed of light.

MS. YANG: Yeah.

THE COURT: So one of you will give me the right answer about the moon.

MS. YANG: I'll go back and watch *MythBusters*.

THE COURT: You'll get that for me.

MS. YANG: Absolutely. Thank you.

MS. CHANG: Good morning, Your Honor.

THE COURT: So your name again?

MS. CHANG: Esther Kim Chang.

THE COURT: Perfect. Thank you.

MS. CHANG: I'd like to begin by explaining some optical concepts as applied to LiDAR applications.

To recap briefly how a LiDAR system works, I'd like to use an illustration from the *Field Guide to LiDAR*. This field guide was authored by Dr. Paul McManamon who is our expert in this case.

This diagram from the field guide demonstrates the basic idea by the LiDAR system. Pulses of laser light are emitted from a light source. They go out into the world, hit a target, reflect off of that target, and come back to detectors and the receiver on the LiDAR sensor.

An actual LiDAR sensor will use multiple laser beams, but for simplicity sake, what we did was shaded all the outgoing light in red and all the incoming light in blue.

LiDAR systems can be categorized as either monostatic or bistatic. A monostatic LiDAR system uses one lens for both the outgoing transmit beam as well as the incoming receive beam.

Monostatic systems were described in a publicly available

reference on laser radar from the National Academy of Sciences. Incidentally, our expert, Dr. Paul McManamon chaired the committee that was responsible for this publication.

Here I've taken an illustration from this reference to illustrate how a monostatic system works. You have light from the laser light source going out into the world hitting a target. The light reflects off of the target and the reflected light comes back to the sensor through the same lens that was used to send the light out.

In the bottom right corner of your screen you'll see a picture of the AGM-129A cruise missile. That's an advanced cruise missile, and in 1983 General Dynamics got a contract to develop this missile. It's a stealth nuclear-capable missile that was used by U.S. Air Force B-52 bombers, and it's one of the earliest examples of a monostatic LiDAR system.

Another more recent --

THE COURT: Well, what did it do? What was it trying to detect?

MS. CHANG: I think targets to hit, Your Honor.

THE COURT: Okay.

MS. CHANG: It's a missile.

Another more recent example of a monostatic LiDAR system is disclosed in the '922 and '464 patents, which are two of the patents that are asserted in this case. As explained by Waymo's counsel, these patents describe a monostatic LiDAR

system because the outbound transmit light and the inbound receive light go through the same lens.

As shown in Waymo's Slide 54, you can see that the red laser beams that are being transmitted from the diodes go through the lens that's labeled 250 and shaded in pink and go out into the world.

The light hits on objects in the world, gets reflected back; and as shown in Slide 56 of Waymo's presentation -- 56 -- the light comes back through the exact same lens labeled 250 and shaded pink. So this is a monostatic LiDAR system.

The other type -- going back to our presentation, the other type of LiDAR system is the bistatic LiDAR system. In contrast to a monostatic LiDAR system, which uses one lens for the outgoing transmit beam and the same lens for the incoming receive beam, a bistatic LiDAR system uses a separate lens for the transmit beam and the incoming receive beam.

Here I've taken an illustration from the ***Field Guide to LiDAR*** that was authored by Dr. Paul McManamon, and as Mr. Jaffe indicated earlier, "TX" is often used as an abbreviation for transmit and "RX" indicates receive.

So in this illustration, this indicates a bistatic system. You can see with the red arrow that I've drawn here that the light goes through the TX or transmit lens out into the world, hits a target, and the reflected light comes back and comes through another separate lens, the receive lens, back to the

LiDAR sensor and then to the detector where that reflected light is analyzed.

One example of a bistatic system is the Velodyne HDL-64E. You have a picture of that in the lower right corner of your screen. I'll go in to more detail on the Velodyne sensor shortly, but for now I want to point out a couple of features of the Velodyne sensor.

THE COURT: Is that what's up there?

MS. CHANG: Yes, sir.

THE COURT: That's the same unit?

MS. CHANG: Yes, Your Honor.

THE COURT: All right.

MS. CHANG: You'll see that the Velodyne sensor has two optical cavities; one on top, one on bottom. Each optical cavity has three lenses. There are two transmit lenses on either side and one receive lens in the center.

It's a little bit hard to tell from this picture, but the two transmit lenses are smaller than the receive lens, and that's because when the light goes out into the world and deflects off of objects, the light becomes scattered and dispersed. So having a larger receive lens helps collect more of the reflected light.

THE COURT: Receive is on the top?

MS. CHANG: No. So actually these are two units that are similar to one another. You have the two transmit lenses

on either side on the top and the receive lens in the center of the top cavity, and you have the same setup in the bottom: Two transmit lenses on either side and one receive lens on the bottom.

The way the HDL-64E is set up is you have a total of 64 laser diodes, but 32 of them are contained in the top cavity and 32 are contained in the lower cavity. And there is a tilt of the two optical cavities to allow for detecting items in different distances. The one -- the optical cavity in the bottom is tilted downward to be able to detect things that are closer to the sensor.

THE COURT: I got that part, but you said that the receive lens was larger, and I understand your logic, but that's only true on the bottom one.

MS. CHANG: I think in the picture it's -- in the picture it's harder to tell because of the downward angle of the lower optical cavity; but if you look here, you can see that this receive lens here (indicating) is bigger than the two transmit lenses on either side.

THE COURT: All right. I take your word for it. I can't tell from that --

MS. CHANG: Oh, sorry.

THE COURT: -- but your diagram makes them look the same.

MS. CHANG: Yeah, the picture is misleading. I blame

our photographer.

THE COURT: Okay. But on the bottom one it's clearly the receive is larger than those two red ones.

MS. CHANG: Yep.

THE COURT: All right. I got --

MS. CHANG: I think if you -- maybe after the tutorial, if you want to come take a look at the device. It's hard to tell from where you're sitting, but the two transmit lenses on either side are smaller than the receive ones.

THE COURT: How heavy is that thing? You can hand it up to me, or is it heavy?

MS. CHANG: May I approach the bench?

THE COURT: Is it heavy?

MS. CHANG: It's 33 pounds. It's not too bad.

THE COURT: All right. Why don't you bring that. Just walk it up here.

MS. CHANG: Okay. Sure.

(Pause in proceedings.)

THE COURT: Put it right here (indicating).

(Pause in proceedings.)

THE COURT: Okay. Here, you can take it back unless there's more that I need to look at.

MS. CHANG: Okay.

THE COURT: I can't really tell. I take your word that it is larger. It's hard to tell because of the cabinet

there --

MS. CHANG: Yep.

THE COURT: -- the housing.

MS. CHANG: This is to point out that the Velodyne sensor is a bistatic system because it has separate lenses for transmit, which are the two lenses outlined in red, and another lens for the receive; and that's multiplied twice, in the top optical cavity and the lower optical cavity. So there are four transmit lenses, two receive lenses in the Velodyne sensor.

THE COURT: How long has the Velodyne sensor been available?

MS. CHANG: Since 2007. So the founders of Velodyne were David Hall and Bruce Hall, two brothers. They founded a company called Velodyne in 1983, and it started as an audio company, an acoustics company. And they specialized in low-frequency sound and subwoofer technology. But then in 2005, you heard about the DARPA Grand Challenge, they decided to enter that competition.

THE COURT: Kind of like the Wright brothers.

MS. CHANG: Yes. And as part of that competition, they developed a LiDAR-based system that laid the groundwork for the current LiDAR products that Velodyne is selling today.

And by 2007, two years after they initially entered the competition, five of the six vehicles that finished the 2007 DARPA Challenge were using the Velodyne HDL-64 sensor.

THE COURT: Does that unit, in addition to having the light-emitting diodes and the lenses and the cavities, does it actually have the computer and the software built into it to evaluate what the return signals are?

MS. CHANG: Yes, Your Honor. So there's a circuit board on top that processes all of the information, and then there's an ethernet cable that sends all of the information to a computer.

THE COURT: A special computer or would one of our computers here in the courtroom work?

MS. CHANG: You know, I'll have to -- I don't know. I would have to confirm that information and get back to you.

THE COURT: It would be kind of nifty if we could hook it up right now and get my computer to show the courtroom. That would be --

MS. CHANG: Your Honor, yesterday I was at 737 Harrison, and from the sidewalk you can see autotrucks with Velodyne sensors spinning. So if you're interested, you could take a walk down to Harrison and Fifth and see that for yourself.

THE COURT: Maybe I will.

All right. Okay. Continue on, please.

MS. CHANG: You may ask -- one thing I wanted to note is -- we discussed the '922 and the '464 patents and how it describes a monostatic LiDAR system. I wanted to note that the

'922 and '464 patents do not cover a bistatic system. They only disclose a monostatic LiDAR system.

You may ask --

THE COURT: Just I don't want to get too far into this part, but on those patents do they -- is the claimed invention one lens? You're making it sound like one lens was already known all the way back to the cruise missile.

MS. CHANG: Well, Your Honor, we think --

THE COURT: What is it that they -- it must be more than that. It must be one lens plus something else.

MS. CHANG: There is more, but may I state what Waymo has stated in their papers?

THE COURT: Yes.

MS. CHANG: Okay. So they tout the single lens innovation of the '464 and '922 patents, and they talk about how groundbreaking the single-lens design was. Obviously we disagree with that allegation because we see monostatic systems in the prior art, and we're talking about some of them today.

THE COURT: Okay. All right. We'll have a lot more on that later on. But, okay, thank you for that.

Please go ahead.

MS. CHANG: So you may ask: Why choose one type of system over another? Well, each system has disadvantages and advantages.

In a monostatic system you're dealing with one lens for

both the transmit and receive beams. Because you only have one lens, it's more compact, it's lighter, but you have this issue with getting some backscatter because you're using the same lens.

On the other hand, with the bistatic system, you don't have that interference issue because the lenses are separated, but then you have to be really careful about aligning the two lenses so that the angular relationship between the emitters and the transmit lens is the same as the detectors in the receive lens because that's the only way that the detectors will be able to pick up the reflected light from the emitting diodes.

THE COURT: Okay.

MS. CHANG: So we've talked a little bit about the Velodyne HDL-64E, and that's the product or the device that I've brought to court today.

As I mentioned earlier, Velodyne is a Silicon Valley company based nearby in Morgan Hill. And we discussed how by 2007, five of the six vehicles that completed the DARPA Grand Challenge used the Velodyne. And today it's the most widely used, commercially available LiDAR sensor on the market, and it's been used by many companies, including the parties to this litigation.

THE COURT: What other self-driving companies are using it?

MS. CHANG: I would say -- I don't have an accurate inventory, but I would say the majority of companies have or are using the Velodyne sensor. There are other LiDAR sensors, but by far Velodyne -- the Velodyne HDL sensors are the most popular.

THE COURT: I read in one of these things Tesla doesn't use LiDAR at all.

MS. CHANG: At all, yes, that's correct, Your Honor.

THE COURT: Okay.

MS. CHANG: So I think both parties have mentioned that there are a lot of different sensor technologies, like radar cameras, and there are pros and cons of all of the technologies. Some people think that LiDAR-based technology, while it is popular in the short term, will be replaced by better camera technology and other sensor technologies down the road.

The Velodyne HDL-64E is a 360-degree LiDAR. You can see it's spinning here. And what it does --

THE COURT: How fast does it spin?

MS. CHANG: So the Velodyne sensor can go from 5 Hz, which is 300 revolutions per minute, up to 15 Hz, which is 900 revolutions per minute. Human reaction time to step on the brakes in response to an object or an event is 5 Hz per second -- is 5 Hz or 300 revolutions per minute. So the Velodyne sensor is at least as good as human reaction time.

THE COURT: Wait a minute. So in one second it goes around how many times?

MS. CHANG: 300 -- sorry. One minute.

THE COURT: In one minute it goes around 300?

MS. CHANG: Yes, Your Honor.

THE COURT: So that would be -- what? -- five in a second? Five times per second?

MS. CHANG: Yes. Yes.

THE COURT: All right. So that's kind of a herky-jerky image, isn't it? Because the old movies used to be, you know, even faster than five frames per second, but I guess what you're saying is that -- all right. The refresh rate is what you're talking about.

MS. CHANG: Yes. Well, it's going around 300 times. So during that time --

THE COURT: But in a minute. Five times in a second.

MS. CHANG: Yes, Your Honor.

THE COURT: All right. But how fast can a car go in a fifth of a second? I don't know. What's the answer to that?

MS. CHANG: My understanding is --

THE COURT: Somebody's going 60 miles an hour -- I'm just curious. If you go 60 miles an hour -- let's work this out -- how many feet per second is that?

MS. YANG: Your Honor --

THE COURT: I used to know the answer to that.

MS. YANG: Your Honor, 60 miles an hour, 1 mile a minute, that's 88 feet per second.

THE COURT: All right. So 88 divided by 5, what is that? About --

MS. YANG: 17.

THE COURT: 17. So between each spin, it goes 17 feet. You could be going 17 feet before you get a refresh.

MS. CHANG: My understanding is --

THE COURT: Is that safe? I don't know. That's something -- a lot of things could happen in that length of time.

MS. CHANG: The current LiDAR devices are limited to a range of 35 miles per hour because if you go faster than that, you outpace the LiDAR sensor.

THE COURT: I see. All right. So that helps. That reduces the problem a lot. Okay.

MS. CHANG: So that's why the parties and other companies that are working in this space have different types of LiDARs. They have medium-range LiDARs, long-range LiDARs. So I believe the HDL-64E goes up to 120 meters, if I'm remembering the product spec correctly. So definitely the LiDAR sensors are intended to only have a certain range.

THE COURT: What is the -- on this particular unit here, you have one that looks down; right? The near field. And we have one that looks -- what? -- you call it the far

field?

MS. CHANG: Out.

THE COURT: The medium field? What do you call that?

MS. CHANG: So you can call it long-range.

THE COURT: All right. You've got the long-range, but the other one is what? Short-range or medium-range?

MS. CHANG: Short-range. It depends. I would probably say medium-range and long-range.

THE COURT: Let's say medium, whatever you want to call. But when it's on top of the car, what are the zones that are being imaged as you drive?

MS. CHANG: My understanding is that medium-range LiDARs typically cover up to 30 meters and the long-range further out, but I may be misrepresented -- misremembering facts.

THE COURT: All right.

MS. CHANG: But I do know that a lot of cars use different types of sensors. So Velodyne also has the short-range sensors, and a lot of people will combine sensors or camera technologies to get objects closer to the car.

THE COURT: So on this particular one we have right here, what is the closest it will image?

MS. CHANG: I don't know, Your Honor --

THE COURT: Okay. That's all right.

MS. CHANG: -- but I can get back to you.

THE COURT: We can learn that.

All right. Okay. You've got about 15 more minutes total.

MS. CHANG: Okay. I will talk very quickly.

We're going to skip some videos that I had.

I do want to show you the end product of a LiDAR sensor. On the left -- this is actually taken from a video featuring Velodyne co-founder Bruce Hall, and he used the Velodyne sensor to image a parking lot. On the left you see a picture of the parking lot. On the right you see the point cloud that was generated using the Velodyne sensor.

The Velodyne sensor will take data at about 2.2 million points per second and generate an image or 3-D map of the car's environment, and that 3-D map is referred to as a point cloud.

We've talked about how a LiDAR sensor works and we've discussed the Velodyne sensor. I want to turn now to a discussion of some of the design and manufacturing considerations that come into play when designing a LiDAR sensor and how those considerations have been addressed by literature in the public domain.

As I noted, in the Velodyne LiDAR sensor, you have one laser diode per printed circuit board, but that's not the only way that you can do it. In the Velodyne sensor you have 32 printed circuit boards on top, each circuit board having one diode. On the bottom you have 32 printed circuit boards, each circuit board having one diode.

But as a 2015 textbook discussed, you don't have to have just one diode on one substrate. You can have multiple diodes on a substrate; and, in fact, you can have multiple substrates with multiple diodes.

This textbook describes a laser stack with three substrates each having 10 laser diodes.

When you have multiple substrates or printed circuit boards, there's an issue that arises, and that issue is: How do you align the circuit boards?

It's really important for a LiDAR sensor to have accurately aligned printed circuit boards, and there's a lot of manufacturing tolerance that affects the manufacture of printed circuit boards. So you have to figure out a way to accurately align the circuit boards so that the laser diodes are also accurately aligned.

The concept of using guide holes to help with the alignment of printed circuit boards is something that has been known to the public since at least the 1970s. For example, in this patent that was filed in 1976 and assigned to a company called Pertec Computer, it describes the use of two holes outlined in red on the right in Figure 1 to assure alignment of the PCB or printed circuit board.

THE COURT: What did that printed circuit board do?

MS. CHANG: What did this circuit board do?

THE COURT: Was that a diode light-emitting thing or

something else?

MS. CHANG: I believe these were laser diodes.

THE COURT: Okay.

MS. CHANG: But I can double-check that for you, Your Honor. This reference is also included in your reference binder.

And on the right it indicates the use of the guide holes to align the printed circuit board to another structure. And the way those guide holes are used is that pins outlined in green in Figure 3 are inserted through the guide holes, and on the left in Figure 2 you see a cross-sectional view of the pins being in the guide holes. And that was how this patent disclosed aligning a printed circuit board to a structure.

There is another alignment issue that comes up when you're dealing with printed circuit boards and diodes, and that's: How do you position components on the circuit board, including diodes, when you are manufacturing these boards?

To solve this problem, it was well known that you could also use holes as a reference point to position internal components.

So here in this patent that was filed in 1981 and assigned to Siemens, it describes location holes 7 and 8 outlined in red, and those location holes are used as a reference point for position determination of components on the printed circuit board. So those holes 7 and 8 are used as a reference point to

get to the X-Y coordinates of other components that you want to place on the reference board.

So we've talked about holes to align printed circuit boards to each other or to another structure, and we've also talked about using holes to position components on the circuit board, but holes are not the only way that you can use to position components on the circuit board. Another way is to use something called fiducial marks.

This is a diagram I pulled from the website from a PCB manufacturer and it discusses the use of fiducial marks to align components on the board. The fiducial marks are the red marks, which are called out by the yellow arrows, and these marks are used as reference locations so that you can measure X and Y positions of other components relative to the fiducial.

Let's take -- okay. I am going to skip my next slide because I see I'm running short on time, and I want to talk about one last issue before I turn it back over to Ms. Yang.

So we've talked about using holes or fiducials to position the diode on the PCB. That tells you how to position a diode on the circuit board, but it doesn't answer the question of what is the best position for a diode. An issue that often arises when you're trying to position a diode on the circuit board is how much of the diode should lie on top of the substrate.

In a 2015 textbook, it describes the issue of how much to

position -- how much of the diode should be positioned on the substrate, and it talks about the consequences of each scenario.

In an ideal world, you will want the laser diode, which is illustrated by the black box in this diagram, you will want it to be flush with the substrate. In our scenario, it would generally be a printed circuit board.

But due to manufacturing tolerances, you can't always get it to be flush, so you have two choices. You can either push it out a bit causing the laser diode to overhang the edge of the substrate, or you can push it in a little bit to make sure that the entire diode is laying on top of the substrate.

The 2015 textbook discusses two considerations that come into play in terms of the benefits or disadvantages of having an overhanging diode versus an underhanging diode.

One thing to keep in mind is heat dissipation. Laser diodes generate a lot of heat and the main way that they get rid of the heat is through conduction. So the more of the laser diode that you have sitting on the substrate, the better heat dissipation that you have.

But the competing concern is that when these laser diodes emit light, if you have it too -- pushed back too far, the laser diode -- the laser beam gets obstructed by the edge of the substrate.

So considerations relating to the overhanging or

underhanging of diodes was something that was known in the public domain, and even as far back as 2007 in a dissertation that was publicly available it discusses the benefits of overhanging the laser diode over the edge of a substrate.

Here the laser diode is labeled "laser bar" and the substrate is labeled "heat sink," and it discusses the benefits of overhanging the diode because it limits the obstruction of the emitting light.

As you can see, the advantages and disadvantages of diode overhang and underhang were well known and out in the public domain.

At this time I'd like to turn it back over to my colleague Ms. Yang.

THE COURT: All right. Thank you.

MS. YANG: Your Honor, I know we're a bit short on time, so let's talk about a question you asked, which is: What happens when you're driving a car at speed?

If you're driving at 30 miles per hour, for example, you're traveling 44 feet every second, which means you want to see more than 44 feet in front because you want to have time to react, to brake or turn your car.

The laser patterns that come out of a LiDAR sensor have a formation called beam spacing, which refers to how you allocate or space out the beams in a given vertical field of view.

As you can see here, the beams that are tilted downwards

will hit the ground or closer obstructions and be bounced back very quickly; but it's the beams that go the farthest into a horizon, which we call the level horizon as 0 degrees forward, it is those beams that will go and show you the object in the distance; for example, the lady on the right-hand side of the slide.

However, you may notice that as beams travel farther from the LiDAR, the space between them becomes farther apart. And as shown in a simplified illustration, the beams will not hit the short cone next to the lady at about knee height, and that's the problem having gaps in the beams that go furthest into the horizon.

One group of engineers tried to solve this problem by looking to nature. Here is a paper published in 2015 from some folks at HRL Laboratories in Malibu, California, and they said (reading):

> "We address this issue by looking to nature and to create a higher density foveate region."

So I was a biology major, and foveated vision refers to something inherit in our eyes. In the back of your eye there's an indentation where the retina thins out slightly and the cones there are in their highest concentration. That means that the cones there receive the most light and see with the greatest visual acuity. In other words, you have higher resolution visually at the center of your vision and lower

resolution at the periphery. Foveated vision is inherent to our eyes.

These engineers at HRL laboratory tried to replicate foveate vision using two LiDARs. What they did was balance one of the 32-channel Velodyne LiDARs, which means one of those gray barrels, on top of the other to create a double density pattern. And let me show you how that worked.

The first Velodyne sensor, 32 beams, illustrated here in simplified form, sends out a pattern; and as you see into the distance, there's a gap between the lasers that go furthest towards the horizon.

THE COURT: I don't understand. What do you mean "gap"?

MS. YANG: If you look at the human, so on the left-hand side when the beams are emitted from a center point, they're very close together. By the time they reach a human, there's a gap. For example, one beam might hit his shoulder and the next beam will go towards halfway down his arm.

THE COURT: You mean as you get farther away --

MS. YANG: Yes.

THE COURT: -- the beams are -- the gap is larger?

MS. YANG: That's right.

THE COURT: Okay. I see that point. All right.

MS. YANG: Okay. I had a Lego diorama I was hoping to bring it out at this moment, but I think we're short on time.

THE COURT: No, no. I want you to finish this point.

MS. YANG: Okay.

THE COURT: You're talking about the strategy of how you do the beams.

MS. YANG: To eliminate the gaps.

THE COURT: So let's hear your point. Go ahead.

MS. YANG: Okay. What they did was they balanced a second LiDAR on top of it to send out 32 beams as well. In this, these experimenters, they balanced two LiDARs together so that there was an overlap region; and where there was a gap before, now there's a denser concentration of the laser beams.

And what they cared about was what they called the fovea, the center region, which is where the person is standing here, and because that is a region furthest in the distance into the horizon and you want to see objects in the distance when you're driving at speed.

Your Honor, if I may move --

THE COURT: I'm sorry.

MS. YANG: Oh, please.

THE COURT: You say -- your title there says "Greater resolution needed for farther distances."

MS. YANG: For objects at farther distances.

THE COURT: But, I mean, just I'm asking. It seems to me that if something is farther away, you're less likely to hit it than something that's real close, like -- so why couldn't

you make the argument that it's more important to have more beams in the near field than the far field?

MS. YANG: The reason is because the beams in the near field, if you have downward tilted beams, they travel, hit the object, and come back very quickly; whereas, the beams further afield, the light goes out, comes back, and in the meantime your car is moving forward. And that's why you would be arriving at, say, the lady in the distance very quickly, 44 feet per second.

And also --

THE COURT: But we're talking about the speed of light. It's so fast that -- I have to think about that.

MS. YANG: I think the point is vertical resolution is about the density of the angles. So having narrower angles between the beams to eliminate gaps between the beams, it's to cover objects of certain size.

THE COURT: All right. So what was the source -- the public domain reference that discussed the strategy for how you align your beams? What was that again?

MS. YANG: For how to align the beams, this paper is a 2015 paper.

THE COURT: The one about the -- they said they were going to follow what nature does.

MS. YANG: Yes. That's this paper, a 2015 paper, from the HRL Laboratories. And so I'm quoting, previously they say,

"We addressed this by looking to nature." That's on page 2. And then we go back and here's an image from page 1 of how they did it, and here's a figure from the same paper.

Now, I just want to close by talking about this strategy was applied using two LiDARs, one balanced on top of each other; but --

THE COURT: Like this one right here.

MS. YANG: Yes. Sort of like this one.

The Velodyne, the folks who made that LiDAR, they actually talked about how to do it within one cavity.

Here is the '190 patent. It was filed on in 2006, issued in 2014. There it talked about having a fan pattern of stacks, PCBs, with one emitter per PCB. However, they say within just that one cavity, you can create an intentionally variable density in your emitters. You can create the higher density at desired regions.

And they close by saying some uses require increased density, which is desirable to facilitate seeing further -- objects at further distances and with more vertical resolution.

And today in the Velodyne LiDAR what they do is they have two separate cavities. The one on top is aimed towards the horizon, and you notice in the spec sheet here from the Velodyne website, that the emitters are more tightly packed together so that the beams that go for the horizon are more densely grouped.

In contrast, the beams which are in the lower cavity which are pointing downwards to see objects closer to you, they're more -- spaced more far apart. And that's in the spec sheet on their website.

In closing, I just want to provide the context in terms of timeline where here above we have earlier autonomous vehicles going through the DARPA Challenge today, and we note that the Velodyne LiDAR you have before you was introduced in 2006 and 2007.

Below I just note that the manufacturing and design considerations you saw just now for individual components in LiDAR were introduced, well-known, and in the public domain in the earlier periods leading up to before 2015.

And with that, I conclude my presentation. Thank you very much.

THE COURT: All right. You two did a great job too. Thank you.

All right. Rebuttal. I'll give you a few minutes for rebuttal if you would like to use that.

MR. JAFFE: Thank you, Your Honor. Just a couple brief points.

Your Honor raised some discussion of the '922 and the '464 patents and kind of what is that design versus the monostatic designs that they talked about before, and I just wanted to be responsive to that point.

THE COURT: Sure.

MR. JAFFE: So there's a couple things to be aware of. Number one is we're talking about the use of a single lens in an example in the specification and then a plurality of laser diodes. And so there are all sorts of complications that come up when you use multiple lasers and a single lens. So that's just one of the reasons why the design that's described in that patent -- in those patents are different from the designs that they were talking about.

THE COURT: So you're saying that the first time anyone ever used more than one diode with a single lens for transmit and receive was in your patent?

MR. JAFFE: I think it's -- I don't want to recite all the claim limitations right here, but I think generally that's the idea.

THE COURT: Really? Okay. All right. Great.

MR. JAFFE: And then the other thing I just wanted to mention is we've talked a little bit about the Velodyne and the pluses and minuses. I wanted to give a little bit more context for the Court on how what's described in the '922 and the '464 patents relates or compares to what's described right here.

And just for the Court's benefit, so what we're looking at there is about 28 pounds and, again, I think, as Mr. Corredor mentioned, it's about $70,000 at one time; whereas, what's described in the '922 and '464 patents, it's about this big

(indicating) and you can -- I don't know, it's probably 5 to 10 pounds at most. And so there's all sorts of manufacturing benefits that flow from these designs that are not present in this design right here, and that actually leads to lower costs as well.

THE COURT: Great. Thank you.

I think both sides did a fantastic job. I learned a lot. We're going to take a short recess, and then we're going to come back and hear your discovery disputes in, say, ten minutes.

All right. Thank you.

(Recess taken at 11:35 a.m.)

(Proceedings resumed at 11:42 a.m.)

THE COURT: Are we ready?

MR. GONZALEZ: We're ready, Your Honor.

THE COURT: Let's see, are the plaintiffs ready? I can wait a few more minutes. Do you have more to come?

MR. GONZALEZ: They're coming right now.

THE COURT: All right. Are the lawyers for Mr. Levandowski here?

MR. RAMSEY: Yes, Your Honor.

THE COURT: All right. Let's take up first the issue concerning -- I'm sorry. I misplaced everything. I thought I had it all here organized -- the one about the Fifth Amendment and the deposition.

Here it is.

Okay. So summarize for me what is the relief that -- what is going on here? What do I need to decide?

MR. PERLSON: Well, Your Honor, so we sent a subpoena to Mr. Levandowski asking for his deposition on Friday and included with it document requests.

THE COURT: You mean this coming Friday you want to take it?

MR. PERLSON: Correct.

THE COURT: What do you mean by "Friday"?

MR. PERLSON: This Friday two days from now.

THE COURT: All right. Okay.

MR. PERLSON: And, you know, we used the allotted, you know, five days that were agreed to under the expedited discovery order; and counsel for Mr. Levandowski accepted service, and shortly afterwards indicated that they thought that the responses -- so we also included some document requests, six document requests.

THE COURT: I'm going to come to that. Some of these are so broad, I'm not going to allow them, but -- they're supposed to be narrowly directed for expedited discovery -- but not all of them. Some of them were okay, but -- all right.

So this -- and so then what? Then what happened?

MR. PERLSON: And so counsel for Mr. Levandowski basically said three things: One, that we're not allowed to

ask Mr. Levandowski for documents under Your Honor's expedited discovery order; two, that they're going to plead -- that Mr. Levandowski is going to plead the Fifth as to every single one of the responses in terms of even producing documents; and, three, that they're unduly burdensome.

THE COURT: All we are concerned about are the document part?

MR. PERLSON: Right.

THE COURT: But he's otherwise going to appear and --

MR. PERLSON: As far as I know. We have not received any objection that Mr. Levandowski will -- as to whether he will appear.

THE COURT: All right. Your turn, Mr. Ramsey.

MR. RAMSEY: Your Honor, Ismail Ramsey and Miles Ehrlich on behalf of Mr. Levandowski.

I think it was summarized well. We received the subpoena for deposition and the accompanying document request. We viewed the order for expedited discovery and did not believe that it allowed for documents.

THE COURT: Well, that's wrong. They're entitled to ask for documents. So that part is wrong, but your part about overbroad has some merit.

So you want me to just give you my take on this? You know, I can tell you right now which ones are overbroad and which ones I'm going to allow. So let's just go through it.

Request Number 1, it's really a sneaky thing. You tried to get two of them in there and called it one. So where -- I'm going to divide it in to two. Misappropriated materials, including media, that contains or contained the misappropriated materials, any documents derived from or reflecting the substance of the misappropriated materials outside of Waymo.

All right. That's -- I'm going to allow that. That one is okay.

The next part is any documents reflecting any meetings or discussions regarding the substance of the misappropriated... I'm going to allow that one too, but that counts as a second request. So those two are fine.

All right. Number 2, any communications re ownership or relationship. That's way too broad. Quashed. Thrown into outer darkness, Number 2.

Number 3, any communication -- all communications between you and Uber between January 2015 and August 2016. That's fine. We're going to require that one to be enforced.

Number 3 -- I'm sorry -- Number 4, all documents regarding your creation of Otto and/or 280 systems including... That's too broad. Quashed. Not enforced at all.

Number 5, documents sufficient to show the nature and timing of Otto's technology. Quashed. Too broad.

6, documents and communications regarding acquisition of Otto by Uber, including all documents. No. Quashed. Too

broad.

These were not narrowly directed, except I'm going to allow Number 1 -- I'm counting it as two -- Number 1 is enforced. Number 3 is enforced. All the rest are quashed.

Now, he's got to appear. You've got to ask question by question. For example, we heard about this motorcycle. You ought to ask questions about the motorcycle. If he invokes the Fifth Amendment, then maybe later on at the trial nobody gets to talk about the motorcycle. You're going to have to -- the Fifth Amendment has to be invoked question by question. It will be a long day, but you've got to go through the process.

Now, sometimes if you get down to a line of questions and Mr. Ramsey says, *Look, anything else on this subject, anything else, no matter what it is, he's going to invoke the Fifth Amendment,* okay, then you have that agreement.

But you can't just wing it and say, *Oh, he told -- he raised the Fifth Amendment, therefore...* You've got to do your job and ask the questions subject by subject and see if he really is going to invoke the Fifth Amendment. Maybe he won't. You don't know that yet.

Now, if you're going to invoke the Fifth Amendment on producing the documents, that's got to be done in a proper way. You need to file a motion for protective order and all of that and do it pronto, but he has to -- he has to produce the documents that I indicated I'm going to enforce the subpoena

on.

Okay. So you can try to talk me out of that ruling. Anything you want to talk me out of?

MR. PERLSON: Understood, Your Honor, on the Fifth Amendment during the deposition, and we'll see how long it takes to go through all those things. We have a limited amount of time and potentially may come back.

THE COURT: I know you do but, nevertheless --

MR. PERLSON: Yeah.

THE COURT: -- you've got to do it. You can't just assume he's going to take the Fifth. I promise you, if you don't ask the questions, later on, if you say, well, you didn't ask it because he would have taken the Fifth, I've seen that scenario. You make the record you want to make.

MR. PERLSON: We intend to make the record, Your Honor.

THE COURT: Mr. Ramsey, do you want to talk me out of any of this?

MR. RAMSEY: I do, Your Honor.

THE COURT: By the way, have you filed your emergency motion yet?

MR. RAMSEY: We are in the process of doing that.

THE COURT: Well, you know, time is running out.

MR. RAMSEY: Your Honor, we expect to have it filed within the next couple of hours, but we wanted to appear this

morning.

THE COURT: All right. I'm not extending the time because I warned you last week you should be ready to do this. We're on an expedited schedule here. If I had more time, I'd be generous with time, but we don't have more time. We're on a very expedited schedule, so I've given you the deadline. It runs out tomorrow.

MR. RAMSEY: I feel the --

THE COURT: So, you know, you've got to ask the Court of Appeals to give you relief because I don't believe you deserve relief, and I'm not going to give you any more time.

MR. RAMSEY: I understand that, Your Honor. We're trying to move as expeditiously as possible; and once we received your order, we've moved right away to try to file the motion for emergency stay. And we've made the required Notice of Appeal and have met and conferred with both parties as to whether they object to the motion for emergency stay.

So we are moving as expeditiously as possible, and obviously we're here today as ordered by the Court to deal with this letter brief motion.

THE COURT: All right. What do you want to say about the tentative ruling that I've given you?

MR. RAMSEY: Just with respect to the document request, Your Honor, we did consult the letter of your order, and paragraph 6 is the paragraph that covered document

requests, and the paragraph itself specifically related to defendants. It said specifically (reading):

"Defendants must produce specific documents 24 hours before that deposition of defendant personnel."

There is nowhere in the order that it talks about documents being requested on an expedited --

THE COURT: I think I clarified it later on, and I will clarify it now. He's entitled -- they're entitled to ask for these documents. So your point is noted, overruled, and we're moving forward.

So if you're going to object to the categories that I have, you need to do a proper -- on Fifth Amendment grounds, you need to make your record.

MR. RAMSEY: Okay, Your Honor.

And in terms of the timing for the production of those documents, just so that I'm clear, because the order, as I said, by its express terms before didn't refer to them and the Court had said before you weren't adding or subtracting from the order as written, and I understand now that there is an addition, but just so I understand specifically what we're up against, the depositions filed for -- or as noticed now for Friday morning, so about 36 hours or so -- maybe a little bit more actually, but a little less than two days -- in terms of when the documents are supposed to be produced for us to be --

THE COURT: At the deposition. At the deposition

would be when they're due.

MR. PERLSON: Your Honor, under the order, they're due 24 hours before the deposition.

THE COURT: I'm going to give them -- because of the confusion, I'll give them until the morning of the deposition. Then if you need more time to review them at the deposition, we'll work out some scheme for you to do it.

I don't think it would be hard. The ones -- I don't believe it would be burdensome to produce. If I understand the record here, there's a thumb drive somewhere that has got everything that was downloaded from Waymo. I don't know how many documents there are that copied any of that, but my guess is not too many; and my guess is there's not many communications between Uber, except the contract.

I was looking in your files -- your filing. I couldn't find the employment agreement that was signed by Mr. Levandowski with Uber. Is there one? I found prototypes that other people signed.

But, Mr. Gonzalez, did you file such a thing?

MR. GONZALEZ: Your Honor, I'm not sure. I'll have to check with our team.

THE COURT: All right. Maybe you can answer that before we're done here.

But, anyway, that would be an example of something that might be in that Category Number 3, but I don't think it would

be burdensome to produce this stuff. So we're going to do it.

If you want to assert the Fifth, then what you do is you assert the Fifth to the production of the documents and you don't have to do it, but you do have to give a privilege log.

MR. RAMSEY: Well, a couple of things, Your Honor, at least with respect to the assertion of the Fifth. And we'll look into doing a protective order, but I don't believe that a protective order is the sole reason -- or sole way -- manner in which an individual can assert their Fifth Amendment privilege. That's one. But we'll look into that and see if we can get one done quickly, but I don't think that that is a requirement for an invocation of the Fifth.

And, second --

THE COURT: On the privilege log, if you want to just submit it to me completed but in camera, I will consider it in camera, and you can give me a brief along with it and explain why it is that the Fifth Amendment would apply. So I'll even make it easier for you. You don't even have to do a protective order, but you do have to give me a privilege log.

MR. RAMSEY: Typically I don't believe that a privilege log is required for assertion of the Fifth Amendment.

THE COURT: I never heard of that. Typically it is in my court, so this is -- under your theory -- under your theory, all kinds of wrongdoing could go unchecked, undiscovered forever until the criminal prosecution is either going to be

brought or not going to be brought. Meanwhile, I've got a case to run here.

MR. RAMSEY: Well, that is the heart of the Fifth Amendment in *Hubbell*, and that is that there is certain information that may tend to incriminate an individual that doesn't have to be produced. I think that is the heart of the Fifth Amendment.

And what we're trying to avoid, I think, is all sorts of complications that could happen down the road in a criminal proceeding where if this Court compels this testimony, be it tacit or direct, that then what the Court will be facing in a different proceeding, if it comes to a criminal investigation and Indictment, is a *Kastigar* hearing. And the government then would be forced to meet its burden to demonstrate wholly independent sources and nonuse of any of the compelled testimony.

So that's the issue that we're dealing with. And in the context of the Fifth Amendment, it is contemplated that there will be certain information that might incriminate or be able to help the government build a case that will be withheld.

THE COURT: What I've told you is that you can submit the privilege log to me in camera without giving it to anyone else, and then I can evaluate whether or not I think which aspects, if any, would be incriminating under the *Hubbell* theory.

So that I'm not ruling against the ultimate assertion of the privilege, but I am saying that you've got to do more than just say in court "Fifth Amendment." You have to do a privilege log. You have to go through the process, otherwise it's an unchecked -- it just is unworkable.

MR. RAMSEY: We do have to provide enough information to make sure -- to allow the Court to be able to determine that the invocation of the Fifth Amendment is proper, but the standards for that are different than the invocation for attorney-client privilege or work product. They're much less. We just have to show --

THE COURT: You submit *ex parte* with whatever it is -- you've got to give the other side enough of the argument so that they can respond to it, but you submit with your privilege log whatever it is that you think is a good argument and I will, of course, consider that. I'm not ruling against you yet on that, on the ultimate answer, but I have to have it. I can't just -- I just can't take your word for it.

MR. RAMSEY: Yes, Your Honor, but I would point this Court to the Supreme Court's ruling in *Hoffman* with respect to the Fifth Amendment, which says it's just the possibility of a -- the possibility of a criminal prosecution being brought. It's not the existence of a criminal prosecution but just the possibility --

THE COURT: Yeah, I understand that.

MR. RAMSEY: -- and then it's the information --

THE COURT: I think there is a possibility here, so I don't deny that that's the right, but that still doesn't get you all the way there.

MR. RAMSEY: That's the first prong, and the second prong is just that the information sought could be used as a link in the chain. It's not that it's inculpatory; it's just that a prosecutor could get a lead, a lead, a starting point for an investigation; and from that information -- and if that's the case, then that is information that is considered incriminating.

And between --

THE COURT: That proposition I don't think I -- I would have to have a Ninth Circuit or Supreme Court decision exactly on -- that says that or close to it before I accepted that idea. That's a very extreme proposition.

MR. RAMSEY: Well, *Kastigar* and I would point you to *Danielson*, Your Honor, in the Ninth Circuit as well, but we can brief this, but *Danielson*, which interprets *Kastigar* and applies it, sets forward the nonuse and the level of -- well, the bounds of the Fifth Amendment. And so it talks about nonuse, both evidentiary and nonevidentiary, and indirect and direct use. But the standards are with respect to the Fifth Amendment, so it's a broad protection.

MR. PERLSON: Your Honor, if I could just respond

briefly.

This is -- once again, Mr. Levandowski's counsel is raising new issues that they didn't seek relief for as they find and react to your counsel's -- to your rulings. If they wanted to be excused from the privilege log that you just ordered, they should have put that in their brief. They --

THE COURT: Look, I'm going to let them do the privilege log. So they can submit that on Friday. They can -- there.

MR. PERLSON: What --

MR. RAMSEY: Your Honor --

THE COURT: You get to make one last point, and then I've got to move on.

MR. RAMSEY: In terms of the timing of the privilege log, there's no way that we are going to be able to complete a privilege log in 24 hours with all else that's going on in this case and having this just been modified.

THE COURT: All right. I'll give you until Monday, Monday at noon.

MR. RAMSEY: Realistically for us to be able to do this search -- and in their letter brief they point to the lack of burden because we are asserting the Fifth; that essentially they say we don't have to do the full search for documents because we're asserting the Fifth to these questions. So even they --

THE COURT: I don't think it's that hard.

MR. RAMSEY: For us to be able to identify any potential document and to go through the --

THE COURT: What you do is item one: Thumb drive containing 14,000 documents. That would be item number one. Item number two: 13 letters from employment agreement. It's not going to be that hard. There would be a way to do this.

MR. RAMSEY: For us to be able to make sure that we've done a full search for these documents, it's not going to be possible, Your Honor, in 24 hours.

Also, with respect to those --

THE COURT: I said I will give you until Monday at noon.

MR. RAMSEY: Even Monday by noon. I mean, ordinarily a nonparty would get 45 days for a document production. We're talking about a situation in which we're responding to the deposition that we're going to be in, there's two depositions that are happening on Friday that relate to the Fifth Amendment issue that's going to spread myself and Mr. Ehrlich thin. We are talking about completing the Ninth Circuit -- I mean, excuse me, the Fed. Circuit motion for emergency stay, and we're still writing the appeal because the appeal itself is due.

And in addition to that, we have items that are coming up in the arbitration with respect to the Fifth Amendment that we

were being requested to brief.

In addition to that, I've been ordered by other judges in other cases. I have to appear tomorrow morning before Judge Westmore and then move to Judge Gilliam in a case. We have put off multiple sentencings for this.

I know that the Court is familiar with the size of our firm, but --

THE COURT: You have associates.

MR. RAMSEY: We do have associates, and they're filing the briefs right now; and we're spreading -- we've spread ourselves as thinly as possible, but I'm just trying to be realistic with the Court and trying to protect our client's constitutional rights, at the same time trying to work with this expedited schedule. But we are a nonparty. They chose not to sue us. They could have. And there's only so much we can do, Your Honor.

And, you know, we yesterday received an order from the Court to file the brief by tonight -- we were in the middle of doing our emergency stay -- we did that. We were ordered to come here today, we did that.

THE COURT: You can -- I don't think you need it because I don't think it will be that long a document -- you can have until Wednesday at noon to supply your privilege log. He still has to appear at the deposition on Friday and to answer questions or invoke the Fifth Amendment on a

question-by-question basis.

And then if the deposition is -- if your objections are overruled on Fifth Amendment grounds, which I'm not saying they will be, then he has to come back and sit again for the deposition.

So we'll take it in those steps. I don't believe that you need until Wednesday at noon to do what I've asked you to do. It overlaps so much with what you're already doing on the Federal Circuit front, that this will be easy to do.

So that's the end of it. I think I've made my ruling on this motion. There's nothing more that I need to do on this one.

All right. Thank you.

Now we go to the one about the inspections.

MR. JAFFE: Before we start, is it possible to take the LiDAR down? I don't want to break it.

(Pause in proceedings.)

THE COURT: That's $70,000. Be very careful.

All right. Let's hear your motion.

MR. JAFFE: Good afternoon, Your Honor.

So as you probably recall, we appeared in front of you last week and we requested to inspect their LiDAR systems, and in particular we requested a couple different LiDAR systems, including one that was described in a Nevada regulatory submission. So what they told the Nevada regulatory submission

is they had this particular LiDAR.

We asked if we could see it. They didn't tell us. They refused to tell us. We asked over and over again. We couldn't get that information. We filed a brief because we were -- I was going to see it yesterday and wanted to have that on file before the inspection occurred.

Subsequent to the actual inspection, which was yesterday, they responded to our letter brief and not to our correspondence asking for this information.

But on this Nevada submission in particular -- and there are other issues but I'm just starting with this one -- they're not -- it doesn't seem like they're actually answering the question that we're asking about.

They disclosed to the Nevada regulatory submission that a particular custom LiDAR exists, and they are now refusing to make it available to us.

THE COURT: They said that was a mistake. They said that what they told the Nevada people was in error.

MR. JAFFE: So -- and this is exactly the point that we've been trying to raise with them. Every time we ask them about this, what they respond is they say *There was no LiDAR disclosed to Nevada regulators.* They don't say that such a device never exists. And when I asked this exact question when I met and conferred with their counsel yesterday, he refused to tell me whether such a device ever existed.

And so this is what we're asking, is to look at this device and the other devices.

And I just want to step back and --

THE COURT: Who was it that made that representation to the Nevada people? What was the name of the person?

MR. JAFFE: So I have it here, Your Honor, and it's filed as Docket 27-32. There's a gentleman named Gautam Gupta. And I Googled him last night and I don't know if it's still the case, but he was chief financial officer of Uber. And this was filed September 15th, 2016.

And the certification says (reading):

"I understand that providing false information or the omission of the requested information in this application" --

THE COURT: All right. Read the one sentence that's the key sentence from that original submission. Read it out loud I mean.

MR. JAFFE: Sure. So I'm going to fast forward to page 10, and it says (reading):

"In-house custom built 64 laser (Class 1) emitting 6.4 million beams a second at 10 Hz."

That's the device we've been asking about.

THE COURT: But what did they say? Read the whole sentence. Wasn't it something like it's under development or -- read that to me.

MR. JAFFE: So there's a long list of things. The beginning of that list, which is I think what you're asking about, says (reading):

"Selected advanced self-driving technologies developed in-house and/or currently deployed in Otto's autonomous vehicles include..."

And then it has this list including what I just mentioned.

THE COURT: Okay. Read the one about the 10 Hz again.

MR. JAFFE: Sure. It says (reading):

"LiDAR - In-house custom built 64 laser (Class 1) emitting 6.4 million beams a second at 10 Hz."

THE COURT: All right. So just hold that thought.

Why can't they see that? First, does that -- what were they referring to whenever they made that representation under oath to the Nevada people?

MR. GONZALEZ: So, Your Honor, we clarified that on Chang Exhibit 8, which is a letter that we sent to the Nevada Department of Motor Vehicles once they saw that they were making it an issue, clarifying that we are developing but we have not yet deployed any in-house custom-built LADAR.

What we --

THE COURT: Well, whether it was deployed or not, it sounds like somebody was working on it.

MR. GONZALEZ: Precisely. And, Your Honor --

THE COURT: That would be an update. Why don't you

let them see what they were working on?

MR. GONZALEZ: Because, Your Honor, we showed it to them yesterday. It's the Fuji.

MR. JAFFE: So this --

THE COURT: Does Fuji track on that description?

MR. JAFFE: So we don't know if these are the same devices, but I can tell you what we know from the information that we have, which is that it doesn't appear to be Fuji. And the reason for this is because the certification that I was talking about was filed September 15th, 2016; and in the papers they just filed last Friday, one of their declarants notes that the Fuji project didn't start until October. And so based on the evidence that we have, Fuji didn't even exist when they were filing this.

THE COURT: All right. So that may be, but answer my question. That description of 10 Hz -- and I've forgotten all the other things. Read it again. There were about six items in there.

MR. JAFFE: Sure. One second, please.

(Pause in proceedings.)

MR. JAFFE: (reading)

"In-house custom built 64 laser (Class 1) emitting 6.4 million beams a second at 10 Hz."

THE COURT: All right. Does the Fuji do that?

MR. JAFFE: It could be. You know, it's not -- we

don't know from the short inspection that we had. We haven't gotten any document production from them on this issue.

THE COURT: Let me ask. Does it do that?

MR. GONZALEZ: Where's Rudy?

(Pause in proceedings.)

MR. KIM: We don't know. Your Honor, we have to confirm that and get back to you.

THE COURT: Who is that that just said something?

MR. GONZALEZ: My partner Rudy Kim, Your Honor. He's the one that was there for the inspection. He knows more about technology than I know.

THE COURT: Why don't we get Mr. Gupta -- is that his name?

MR. JAFFE: Yes, Your Honor.

THE COURT: Bring him in here, put him under oath, and I can ask him or you can ask him *What in the world were you talking about?*

MR. GONZALEZ: That's what I've suggested, Your Honor. I said, *You can take people's depositions and ask them the questions you want to ask and you'll get your answers.*

We're not hiding some device, Your Honor. We've got two devices basically and we showed both of them to them yesterday.

THE COURT: But just be clear, I read your papers and there's a difference between prototypes and final devices or devices and work. For example, whenever I do an order, the

final is the order but along the way I do a lot of work. My law clerks do a lot of work. It might have a lot of things that get cut out on the cutting room floor.

I am concerned from the narrow way in which you have presented your opposition that you are focusing on two things -- Fuji and the original Velodyne -- and you are ignoring all of the other work, and you never mention what Mr. Levandowski did. You always talk about the professor, but you never say what he was working on. Well, why did you hire that guy for 680 million if he wasn't doing anything? So I wonder, what was he working on?

It does leave the impression that you have cleverly written around the problem of what was Levandowski working on all this time even if it didn't turn into a prototype. That's a fair question and they're entitled to an answer on that.

And so if it turned out that the Nevada thing was one of those projects or work, even if it wasn't a project, then they ought to get a chance to see whatever it was.

MR. GONZALEZ: So what I've told them, Your Honor, is they're going to have an opportunity to take a lot of depositions. They can ask all those people those questions.

There is one other device, Your Honor --

THE COURT: You're evading. You're not giving me a direct answer. You're not giving me a direct answer.

Was there something -- are you telling me there was

nothing, absolutely nothing other than Fuji was the reference in that Nevada thing?

MR. GONZALEZ: Your Honor, my understanding is the only other thing that could have been referenced is the commercially available Velodyne that was here on the counter.

And there's one other that we did show them yesterday, Your Honor, because we tried to be overinclusive in what we showed them. We brought something that was called the "Owl," which was, I believe, a predecessor to the Fuji, and it's no longer being developed, but we brought that as well.

THE COURT: Were there any other things that were just on the drawing boards or in schematics? Any other work on laser that never got to the stage of a prototype or even close to a prototype but, nevertheless, represented work and thought and planning?

MR. GONZALEZ: That, I don't know, Your Honor. I was focused on their request was about Nevada; and what I can tell you is that with respect to Nevada, there was the Fuji and there was the Velodyne.

THE COURT: All right. What can I do? Look, you're asking me to do the impossible. It's Mr. Jaffe; right?

MR. JAFFE: It is.

THE COURT: Mr. Jaffe, what do you want me to do? What is the relief you're seeking here?

MR. JAFFE: So what I think we would seek,

Your Honor -- and just to respond briefly to what he said -- we think we're only getting a small slice of the story here. They're talking about this Fuji device, which started work in October, and they're leaving out this entire timeline where Mr. Levandowski and other folks, what were they doing for the past eight months?

THE COURT: Well, focus just on Nevada for a minute. What can I do to help your problem on Nevada in the face of what's being represented to me?

MR. JAFFE: Well, I think we first --

THE COURT: In due course you will get to take those depositions. Maybe you'll find that there's more to the story than has been told me, but right now what can I do?

MR. JAFFE: Sure. I think as an initial matter, what we'd ask for is if there's a design that that relates to, we want to look at it. And if there are other designs that they have, dead-end designs, prototypes that they have that they jettisoned in anticipation of this litigation, we would want to look at those devices.

THE COURT: When did the correction get sent into the Nevada people?

MR. GONZALEZ: March 15th, 2017.

THE COURT: Well, what took them so long? March 15th, 2017, is when this litigation was underway.

MR. GONZALEZ: That's correct, Your Honor.

THE COURT: That sounds like somebody's fixing the record.

MR. GONZALEZ: Well, that -- I'm not going to deny that, Your Honor. In their papers they cited this letter to Nevada. We looked at the letter. We discussed it with our client. The letter wasn't clear, so we submitted a clarification.

THE COURT: All right. Is Mr. Gupta still with the company?

MR. GONZALEZ: Yes, Your Honor.

THE COURT: Why don't you depose him? Have you gone and interviewed him to see what he was referring to?

MR. GONZALEZ: Someone on my team, Your Honor, has dug into this, and that's why we sent the clarification letter.

THE COURT: I will just say this: I'm not ordering anything more on the Nevada front. I will just say that I absolutely believe that plaintiff is entitled to inspect whatever was being referred to back at the time, not in March but back when that thing was filed with the Nevada people in 2016. Whatever that was that was being referred to, they're entitled to look at it even if it never got to the level of a prototype. If it was just work in progress and thoughts in progress or designs in progress, they're entitled to see if any of their secrets were being used.

So I'm just making that observation, but there's nothing

more that I feel that I can order. It's a legitimate request. They've told you -- they've given you an answer on it. So for these purposes, you've got to live with that answer.

All right. What else can I help you with on your inspection front?

MR. JAFFE: So I think that was the main issue, and I've addressed the other devices that we don't know about. So I think you've given us what we've asked for in terms of the device that we do know about.

What we would ask for is if there are devices that we don't know about from previous -- from the past year, we do want to inspect those and I would just reiterate that request.

And perhaps as a middle ground --

THE COURT: Well, I'll give you -- I've thought about this problem. How long was Otto in existence before Uber came along?

MR. JAFFE: I mean, that's unclear to us before Uber came along. They served a privilege log and the first date --

THE COURT: Were they working on -- for example, before Uber bought them in August 2016, was Otto working on something? What was the design then?

MR. JAFFE: We don't know. We want to know.

THE COURT: I think that would be a legitimate design for you to get your hands on. The next one would be whatever Mr. Levandowski was working on. Even if it never got to the

prototype stage, even if it just didn't get to the device stage but it was just something on paper that was a possibility that they were mulling over, that's okay. That should be -- that should be discoverable.

So it's not even -- I mean, you're characterizing it as a device. I'm saying that even before the predevice stage, the thinking stage, the work stage, the analysis stage where various designs are being thrown about, as long as Mr. Levandowski was working on it, I think that's fair game.

Now, maybe you haven't asked for that, and that's for the future, but that -- I'm just saying in the future, that ought to be fair game.

So, again, I don't know what specifics I can order for you today.

MR. JAFFE: What I think we can do is we can ask them to make all the material that you've just described available, and we can come back to you if there's any problems with it.

MR. GONZALEZ: So, Your Honor, I think you've said it right. It's not clear that they've even asked for it.

The way this started, if you recall, is you asked us to make the device available for their inspection. We did that. Everything that you just said that they're entitled to see, I think a lot of that we're already collecting in response.

THE COURT: That's a good point. That's a good point.

MR. GONZALEZ: Yeah.

THE COURT: And I should learn my lesson by now. Mr. Verhoeven stood up and on the fly without a letter, without anything, he just said, *We want to inspect,* and I got sucked in and I said, *You've got to let them inspect*, because I thought it sounded reasonable.

But when these things come out of left field and then I have to make a ruling on the fly -- not have to make, wind up making -- I should learn my lesson by now -- then we get into jams like this.

And so, Mr. Gonzalez is correct that this was not even a letter that you sent them. It was an on-the-fly, out-of-left-field thing and that I said okay to.

So I do think you're entitled to see those inspections, but I have now morphed off into not the inspections but looking at documents, design documents, communications with Mr. Levandowski that may not have a thing to do with actual designs and inspections.

So I am -- I'll just leave that thought out there for you, but I feel like I've given you all the relief I can on inspections, which was the subject of your letter. Okay?

All right. Now we're going to go to the other side's complaint that you're working hard supposedly and, yet, come to find out you've got someone named Stroz doing your work for you.

MR. GONZALEZ: So, Your Honor, I want to clarify that,

and in hindsight I realize we should have submitted a declaration from our firm.

So, Your Honor, we have 42 contract lawyers who have been working around the clock since Friday afternoon. We also have 11 Morrison & Foerster lawyers who have been contributing to this effort. So it's not just Stroz. And then with respect to Stroz, Your Honor, it's not just one guy. We have 39 people at Stroz.

So we're throwing a ton of resources at this. And as it turns out, Your Honor, it's just impossible to do what you've asked us to do in the limited amount of time, and we wanted to raise that with you.

We've spent 1550 hours since we were here, including, Your Honor, I think --

THE COURT: All right. It does seem to me they deserve some more time.

MR. JAFFE: So --

THE COURT: Look, you're the one that wants this on a hurry-up basis. If you want to push the hearing out -- I mean, I think you -- you're the plaintiff. You've got to make -- you can't have everything. So we either have the early -- early, it's not that early -- but we either have the hearing on May 3rd, but you're not going to get a full deck of cards. You're going to get a half a deck of cards because it's all expedited. It's impossible to get everything. Or we can push

it off two months and you'll get 25 percent more.

So what do you want to do?

MR. JAFFE: So I think it's --

THE COURT: I feel like he's raising -- Mr. Gonzalez is raising a good point.

MR. JAFFE: So I want to -- if I may make two brief points, Your Honor.

The first point is we don't want to move the hearing, and we're willing to do whatever it takes to keep the hearing. So I'm going to start with that point.

But the second point, which is the broader point that we've tried to underline in a couple of our letters here, which is we don't think that the kind of -- Stroz Friedberg, which is a forensics firm -- the analysis that they're doing is really an effort to find the files that were taken. And let me just tell you why.

Because --

THE COURT: What kind of firm is that? I don't know. Practice must have changed since I was -- what do they do for a living?

MR. JAFFE: They do forensic analysis.

THE COURT: What does that mean, though?

MR. JAFFE: So that means they're going to look at one file and see if it has similar metadata to another file. They're not going to look at the technical substance of any

sort of trade secrets or content. They're just going to compare file name to file name or metadata to metadata and say, *Ah ha, I found a match.* But there's no sort of intelligent analysis between the two things.

And so to us them saying *Stroz is working X number of hours* is not responsive to Your Honor's order that they had on the 13th and, I'll add, agreed to at our initial case management conference.

So for us -- for them to come in and say, *We can't do it,* what they've been doing doesn't make sense.

THE COURT: Well, you came in when the order didn't say specifically that you could depose third parties or get documents from a third party. Okay. You got a little add on there, and so he gets a little consideration too.

MR. JAFFE: So I -- we spoke earlier, and I think for at least some of the custodians that we identified, we told him that we would give him, I think, three or four more days. And so we don't oppose a modification in that fashion.

We're trying to work together. We're not being intransient, but our kind of dispute is as to how they're doing the search. Because they've stood up a number of times and said *The files never made it to Uber. The files never made it to Uber.* But they didn't even come and look at the files. Mr. Gonzalez has never seen the files unless he saw them from Mr. Levandowski. So for them to say they never made it to Uber

without even looking at the files doesn't make sense to us.

THE COURT: Well, maybe Mr. Levandowski told Mr. Gonzalez that they didn't make it. Maybe they've got a good source.

MR. JAFFE: We'd like to find out.

MR. GONZALEZ: You're getting warm, Your Honor. Those files are not, I think, at Uber, Your Honor.

But here's what we agreed to do an hour ago, or a couple of hours ago it seems like. We met at 9:00 o'clock --

THE COURT: That doesn't mean that they weren't used. It just may mean that they're not physically on site.

MR. GONZALEZ: Your Honor, it is my view that they were not used either, and I think we'll prove that.

But here --

THE COURT: I don't know. I don't know. That's a wholly different point.

MR. GONZALEZ: Your Honor, here's what I wanted to inform you about. We met at 9:00 a.m. and we did confer, and what we've agreed, Your Honor, is that our experts -- we've been asking for this -- they have now agreed that our experts will get together with the lawyers tomorrow to try to come up with a plan.

Here's my response to we're not looking in the right place or we're not looking the right way. Here's my proposal. I said *We will do anything reasonable that your side proposes to*

find these things because, in my view, we're looking for a ghost; but we will do whatever is reasonable that they propose, and they haven't proposed anything.

So tomorrow we're going to meet with our experts, get together, and hopefully we'll come up with a proposal; and if they have a way to streamline, we'll do it.

I'll also note just briefly, last time we were here, you asked him to give me 10 more names to search. Remember that? Well, we just got five names yesterday. I still don't have the other five. I'm not complaining. I'm just raising it as an issue.

THE COURT: Is there -- Mr. Cooper here, what do you think about having Mr. Cooper go to Uber and just park there -- himself there, not as your client, not -- he would be an officer of the court for me, a special master, to help me figure out and maybe hear both of you out, learn what the files are, learn how these searches are being done, and come back and give me a recommendation?

This is not to suspend anything that you're doing already, no. This would be, *Judge, here is a way to get more quickly at what would be most probative in this case saving for later some of the other things since we're on an expedited schedule.*

I personally think that would be -- that he is more qualified than I am to do that kind of a thing, and I would like to have him employ that, but I don't want to do that

unless both of you agree.

MR. GONZALEZ: I love it and I suggested it at the break before you came back to the bench, Your Honor.

THE COURT: What do you say to that, Mr. Jaffe?

MR. JAFFE: So I think, first, I just want to understand the protocol that you're envisioning. Would it be that Uber would have *ex parte* communications with Mr. Cooper without us there?

THE COURT: I think -- I don't know. He would have to do some investigating to -- if you want to be there too, okay, I guess, but somebody from your firm could be there at all times.

MR. GONZALEZ: Your Honor, that is the only place I would draw the line is, if we're talking about them coming into our building, I would be concerned about that.

But I'm fine with Mr. Cooper participating at our meeting tomorrow where our experts are going to talk about what the situation is, what the status is; and I'm also fine with both sides separately spending half an hour with Mr. Cooper explaining their views. Both sides can explain their views.

THE COURT: Why can't we do something like that?

MR. JAFFE: I mean, I think we can do something like that.

THE COURT: What do you think, Mr. Cooper?

MR. COOPER: I think that would be fine. I am

somewhat concerned about unilateral communication, but if that's worked out between the parties, I'm okay with it.

THE COURT: Well, let's do this: Now, for the time being, subject to changing, this is not fixed, but for the time being, his fee would be 50-50.

MR. GONZALEZ: Correct. We've agreed to that, Your Honor.

THE COURT: All right. But at the end of the case or maybe even before that I might say, if I get upset with Mr. Gonzalez and his client, that you pay 100 percent --

MR. GONZALEZ: Understood.

THE COURT: -- and shift it all back; or if I decide this case was trumped up to begin with, maybe you wind up paying 100 percent. But for the time being 50-50.

I would like you to do a couple of things. I would like you to go to this meeting. I would like for you-all to agree on a framework of -- you know, because there's got to be -- what's the word? -- a reference, an order of reference, a commission in other words, and then you've got to sign it saying you'll do it. But I think you three could craft that better than I can.

MR. COOPER: Yes. We had a conversation yesterday, and I believe we agreed to the terms, and I have an engagement letter here. We can do a commission. We can do an engagement letter.

THE COURT: I think it ought to be -- look at the rule -- I think it's 54 or 53 -- and see what special masters -- I think there are rules on this, and I don't want to get -- so, okay. You submit that to me.

MR. COOPER: Okay.

THE COURT: Now, that's not the -- I think that may be just the first in several projects, but let's start with just one project.

MR. COOPER: Okay.

THE COURT: My goal is we're on an expedited schedule. There's no way the plaintiff is going to see everything that they want to see, but they are entitled -- and I'm impressed with the amount of work that you have done on Mr. Gonzalez's side, but given that we have short time, the resources ought to go into whatever endeavor is going to produce the most probative evidence.

And, by the way, if that turns out to be manual review of desk files, like if Mr. Levandowski had a desk file -- like I have desk files, you probably have them -- a manual review is good and do that. If it turns out that computer searches are the way to get at it most effectively, do that instead. I don't know what the right answer is, but we are on a short fuse. We have a hearing on May 3rd.

But I want to give you an extra week to complete what you owe me, and I want over and above that for Mr. Cooper to help

both sides and me figure out the best way to use our time.

Now, one thing, there's a condition on that, is I've devised four interrogatories that I'm going to have Mr. Gonzalez answer. So I'll send those out today, but -- and the reason I crafted them is that the answers will help me -- I'm going to give you till, I think, April 25 so it's not immediate -- it would help me in deciding what the right -- how to manage what the shape of the discovery plan ought to be going forward, and I think it would produce some worthwhile evidence anyway.

MR. PERLSON: Your Honor, if I can just point out one thing. Mr. Perlson again.

Our brief is due on April 21st at noon, and so if we extend that deadline, I think it could actually be past the date that that's due.

THE COURT: I'm sorry. What do you want me to do about it?

MR. PERLSON: Well --

THE COURT: Maybe if they come up with something in the -- I don't want to extend your date. It's an enormous amount of paper I've already got to read. Maybe if there's some great document in there, you can do a supplement.

MR. PERLSON: That's all I was going to propose, Your Honor.

THE COURT: Okay.

MR. GONZALEZ: So, Your Honor, I'm going to keep our people working literally hundreds of hours every day, but I want to say this to you now, because I want to be straight with you from the outset: All of the amount of data that you asked us to review, if I'm doing my math right, it's almost half a billion pages of data. There is no way, it's not humanly possible to do that even within a week.

And so what we're going to do is we're going to keep the pedal to the metal, and I'm going to have people work all weekend, like we have the last four weekends I think now, and continue to do this. But I want you to know that given the scope of what you asked us to look at, every server in the company --

THE COURT: Well, you know, maybe Mr. Cooper can recommend a way to prioritize what I've asked you to do --

MR. GONZALEZ: Yes, exactly.

THE COURT: -- and keeping in mind not only the burden but the likely probative value.

MR. GONZALEZ: I agree, Your Honor. That's what we need to do and that's what I've suggested to the other side so we can -- you know, whatever they want us to do within reason, we'll do it.

THE COURT: All right. Now, one last thing. Magistrate Judge Corley has graciously agreed to take over all the discovery fights, but she can't start on that for sometime.

This would be in addition to Mr. Cooper, and I'm sure she would find Mr. Cooper to be of enormous help too.

By the way, you get paid in this case.

MR. COOPER: Thank you, Your Honor.

THE COURT: All right. Everyone ought to know that Mr. Cooper *pro bono* did a huge thing in the *Oracle versus Google* case, and he did that without any compensation; and he's a model of what lawyers are in this district, and so -- but this time I want it to be clear, you get paid.

MR. COOPER: Thank you.

MR. JAFFE: Your Honor, may I make one brief point?

THE COURT: Wait. Wait. I'm not finished.

MR. JAFFE: Oh, excuse me.

THE COURT: So, anyway, Judge Corley would like, for planning purposes -- maybe if you could come too, Mr. Cooper, that would be good -- at 10:00 o'clock on Friday she can meet with you to kind of go over -- she's not going to decide anything. She just wants you to say hello, tell you how motions will be filed in her court. I think she does it kind of like the way I do it on a hurry-up basis, but it would be good for you to send somebody who -- please go see her at 10:00 o'clock on Friday.

MR. GONZALEZ: We'll do that, Your Honor. Thank you.

THE COURT: All right. Now you may make your point.

MR. JAFFE: I just had one -- I wanted to seek

guidance from the Court.

So we received at 11:00 p.m. last night a privilege log from them, and it's 700 pages long comprising 2400 plus entries. And so as you might imagine --

THE COURT: But there should not have been any redactions in that.

MR. JAFFE: So there were redactions in the copy that we received.

MR. GONZALEZ: Let me explain what happened, Your Honor.

So we've been working on this log. As I told you last time, it was 300 pages last time we spoke and now it's 700. When you issued your order, you divided up the log into those impacted and those not impacted by your order. Frankly, we just weren't able to split it out that way by 11:00. So what I did, Your Honor, was I gave them a log that was overinclusive. I gave them everything that --

THE COURT: I want you to give them one so we know that these don't depend on the Fifth Amendment.

MR. GONZALEZ: And the way they know that, Your Honor, is because -- if you really want one, I can give you a set -- everything that's not redacted is not impacted by the Fifth Amendment. That's the easy way for them to tell.

The only thing that I redacted, Your Honor -- and I'm choosing my words very carefully -- is the same thing that we

redacted in the log that you've seen. That's it. And so everything --

THE COURT: So is this a fair statement? What you gave them that is unredacted has nothing to do with the Fifth Amendment?

MR. GONZALEZ: Correct.

THE COURT: And the ones that are redacted, those are the ones that turn on the Fifth Amendment issue?

MR. GONZALEZ: That is correct. On the issue that Your Honor ruled on that is now being appealed, correct.

THE COURT: All right. I'm okay with that as long as you understand it that way.

MR. JAFFE: It is, and so I was -- and we kind of understand that with that clarification.

The point I wanted to raise was that as you might imagine, we have some serious concerns about how privilege is being asserted here. The first date on this log that we found is three days after Mr. Levandowski left Google at the time where they're saying it's anticipation of litigation three days after he leaves.

At the same time Mr. Gonzalez and I were meeting and conferring this morning, and I was asking him: Is Mr. Levandowski working on LiDAR? And they kind of -- he wasn't really sure. And I asked if he was walled off from their LiDAR designs because they put that at issue in their

papers. And, you know, I didn't get a straight answer.

THE COURT: Three days was three days after what?

MR. JAFFE: Mr. Levandowski quit Google.

THE COURT: So I missed it. So that was well before August 2016.

MR. JAFFE: Correct.

THE COURT: All right. So what he was working on -- he was working on -- he wasn't part of Uber at that point.

MR. JAFFE: They're putting in their log that they were anticipating litigation with Google at the time relating to this due diligence starting three days after he left.

THE COURT: Who's the "they"? You mean there was a joint defense agreement way back then?

MR. JAFFE: That's what they're asserting.

THE COURT: Is that in the redacted stuff or in the -- which group is that in? The redacted group or the unredacted group?

MR. PERLSON: Your Honor, sorry to interrupt here, but it's a long log and I looked at this part of it.

So the -- it's in the unredacted portion of it. And what's so remarkable about it is that as Mr. Jaffe said, it's two, three days after Mr. Levandowski left Google. And the recipient of -- there's one e-mail from a Mr. Tate, who's counsel for Uber here, and there's a recipient that is at Uber, a Mr. Surh (phonetic) at Uber, and then there's others cc'd on

it at Uber, and this is the subject matter, it says (reading):

"E-mail providing legal analysis or advice in anticipation of litigation regarding due diligence for potential acquisition of Ottomotto."

And then it's an e-mail reflecting communication made in confidence by Anthony Levandowski and/or John Gardner, who I think is one of Mr. Levandowski's lawyers, pursuant to joint defense agreement to further investigation for the purpose of obtaining or giving legal advice in anticipation of litigation regarding due diligence for potential acquisition of Ottomotto.

So we have this incredible situation where three days after Mr. Levandowski has left Google, months and months before any acquisition by Uber of Otto, that they are claiming that there is somehow a joint defense common interest privilege regarding an anticipation of litigation.

THE COURT: Well, the written joint defense agreement was later.

MR. PERLSON: Yes, in April, three months later. And so --

THE COURT: When was this then?

MR. PERLSON: This is January 29th, 2016.

THE COURT: All right. So they'll say they had an oral agreement.

MR. PERLSON: What we're saying, Your Honor, is that this is a -- and I guess, you know, perhaps this is a preview

of some issues to come, but there are 700 pages of logs of apparently an anticipation of litigation between Otto and Uber and Mr. Levandowski that stems -- starting back three days from when he left.

THE COURT: Here's one thing I don't get. The one you read to me, is that redacted in any way?

MR. PERLSON: No.

THE COURT: All right. So that one is not redacted.

Okay. So just to be clear, I see the distinction now. The Fifth Amendment issue -- or let me put it differently.

The things that are allegedly covered by the joint defense agreement could include a lot more than just the Fifth Amendment issue. So that's why that one's not redacted I guess.

MR. GONZALEZ: That's correct, Your Honor.

THE COURT: All right. So isn't this something that you'll in due course bring before Magistrate Judge Corley?

MR. PERLSON: Well, I think that it may well be, and I think we wanted to flag it because it's part of what Mr. Jaffe is saying, is that without Mr. Levandowski involved -- and apparently it's unclear what exactly they've even asked for Mr. Levandowski in terms of his documents even while he was at Uber or at Otto -- that this investigation is manifestly incomplete as shown by the fact that from the very minute that he apparently left Google, he was working on anticipation of

litigation with Google or Waymo.

And, additionally, I'll note that Mr. Levandowski himself -- I mean, I did a word search using the PDF -- doesn't appear anywhere in this log himself individually.

THE COURT: I thought when you read that one off, I heard the name "Levandowski."

MR. PERLSON: Right. That's what's curious about it. That's the description, but he's not a recipient of the e-mail.

And so when we asked counsel about this earlier as to why is it that every single one of the recipients and custodians on the 700-page log is listed as Morrison & Foerster, the answer is that this is not Uber's privilege log that you ordered to provide. It's Morrison & Foerster's privilege log.

Now, we are told there will be a short privilege log from Uber later this week that we haven't received yet, but one wonders how it is it would only be short and that this log doesn't contain anything from Mr. Levandowski when they have been working on from -- apparently for eight months on this. Every single one -- almost every single one of these is anticipation of litigation that seems to stem from what happened when Mr. Levandowski left.

So we seriously question what they've really searched for of Mr. Levandowski given the fact that his name doesn't even show up here as a recipient.

THE COURT: See, this is what Mr. Verhoeven did to me.

He out of left field stands up and makes a speech like that, and I get sucked in and say *You get an inspection.* So you're now trying to get me to make some kind of ruling, and I'm not going to do it. It's going to go to Judge Corley. It sounds interesting.

MR. PERLSON: Your Honor --

THE COURT: It sounds interesting.

MR. PERLSON: Understood, Your Honor.

THE COURT: Is it true that you haven't completed the privilege log from Uber like you were supposed to have?

MR. GONZALEZ: No, no. Here's what I told them. What I said to them is two things. Number one, it is not our intention to log the same exact e-mails that are on that 700-page document from the Uber side. In other words, Uber was our client. If there's an e-mail from MoFo to Uber --

THE COURT: I don't know that you're right about that I think because the copy at Uber may have been shown to somebody who shouldn't have seen it and that would have been a waiver. I think you've got to log both of them.

MR. GONZALEZ: Well, here's, Your Honor, what -- I understand I think in part what you're saying.

Obviously if we sent an e-mail to somebody at Uber and that person forwards it to anybody else, we're going to log that. I'm just saying that if it's simply an e-mail from A to B, it would just be a dupe, a duplicate e-mail.

THE COURT: Well, I'm not even blessing the forward thing because that's something you're --

MR. GONZALEZ: And the last thing --

THE COURT: They could have showed it to somebody --

MR. GONZALEZ: Sure.

THE COURT: -- that was not authorized, not forwarded to them. Just said, *Hey, look at this.* And they might know it. I'm not blessing the idea that you can omit the other people's copies.

MR. GONZALEZ: And the other thing that I told them, Your Honor, is because of the issue that we've been discussing, we haven't completed -- we're nowhere near completing the Uber review, is that I'm just going to give them a rolling privilege log as we get through the documents.

And what I've told them is that thus far we don't have very many. We don't have very many from Uber that would even fall on to a log; but I said, *By the end of the week, I'll give you what we've got to date*, and I'll just give them a rolling log as we get through the stuff. And that, too, we can discuss with the special master.

THE COURT: Mr. Cooper is going to solve this problem for me too.

MR. COOPER: We can certainly talk about it.

THE COURT: Can I just ask who else are you deposing on your side now? I'm curious now that I've read these

declarations and so forth. Who are you deposing?

MR. JAFFE: We are deposing the declarants that they put forward, which I think was on the range of five to seven, maybe a little bit more, and then we've noticed Mr. Levandowski's deposition.

THE COURT: I have a legal question for you. Does the Federal Trade Secrets Act cover proprietary information as well as trade secrets or only trade secrets?

MR. JAFFE: I think -- offhand I think it covers only trade secrets.

MR. GONZALEZ: That's correct.

THE COURT: How about the state law?

MR. JAFFE: I think it also talks about trade secrets, but there's a broad definition of what is a trade secret.

THE COURT: Is it true that in order for me to grant a preliminary injunction -- this is what Mr. Gonzalez's brief said -- that I have to specifically find that there was a trade secret in the 14,000 documents as opposed to just, *Okay, this is all confidential, this is proprietary*? But do I have to find that there was actually a trade secret, something that qualifies as a trade secret in there?

MR. JAFFE: So I think under the -- as we've alleged under the Federal Trade Secret Act and the California Act, we've requested an injunction based on those; and so to do so, I think there would have to be some findings as to whether

something is a trade secret.

THE COURT: Have you covered that point in your opening brief?

MR. JAFFE: Yes, Your Honor.

THE COURT: All right.

Okay. My thanks again to Mr. Cooper.

MR. COOPER: Thank you, Your Honor.

THE COURT: And I want you to know, I think you may have already figured it out from my calendar, but tomorrow my wife and I are leaving for a week. I'm leaving for a week anyway. I'll be out of the country. It will be extremely hard for me to rule on anything. I will say if it was a true emergency, they could reach me and I could possibly get a short order out, but it's unlikely. So I hope while I'm gone you don't -- if you really need emergency relief, it's going to have to go to the general duty judge because Judge Corley is not available either.

So why don't you two behave for a week and reduce your fights. All right?

MR. GONZALEZ: We'll do that, Your Honor.

THE COURT: Tell me, I'm just curious, how many of these lawyers out here are working on the case just so I can welcome them to the court?

MR. GONZALEZ: Raise your hand if you're working on the case, if you're a lawyer working on the case.

THE COURT: Good. Welcome to you.

And how about over there? Any of you working on the case? How many? Raise your hand again. So just two people over there.

All right. Well, my sympathies are with these young people, and I applaud you for getting some of the younger people up here to perform today, and I encourage that. I think it's important that they learn to stand where you're standing and perform and not just sit in front of a computer doing word searches. So I hope to see all of you up here at some point in the case.

We're done for today; right?

MR. GONZALEZ: Yes, Your Honor, I believe so.

THE COURT: All right. Thank you.

MR. GONZALEZ: Have a safe trip, Your Honor.

MR. JAFFE: Thank you.

(Proceedings adjourned at 12:50 p.m.)

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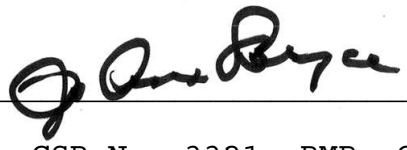
CERTIFICATE OF REPORTER

I certify that the foregoing is a correct transcript from the record of proceedings in the above-entitled matter.

DATE: Thursday, April 13, 2017



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